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PULP & PAPER
NORTH AMERICAN INDUSTRY FACTBOOK

1982-83

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Information in this volume is designed to present a comprehensive review of the structure and status of the pulp and paper/board industry of United States and Canada. Every effort has been made to provide accurate data. To the best of the editors' knowledge, data are reliable and complete, but no warranty for this is made.

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NORTH AMERICAN OVERVIEW

North America is the world's most important pulp and paper producing region, accounting for about 50% of worldwide pulpmaking capacity and 40% of paper and paperboard capacity.

Paper and paperboard production should just about match general economic activity during the decade of the 1980s. Domestic demand may grow slightly less than real gross national product because of growing competition from new forms of electronic communication in paper markets and from inroads by plastics in the packaging area. However, exports of paper and paperboard should show faster growth than domestic demand because of North America's position as a low-cost producing region in the world.

The North American Overview is divided into two sections: United States, and Canada. For each country there is a chapter that examines trends in production, exports/imports, prices, profitability, capital spending, capacity expansion, mergers and acquisitions, employment, wood supply, environmental control and regulations, energy and chemical use, and transportation costs.

FINANCIAL DATA

All sales and earnings figures are shown in U.S. dollars, unless indicated 'C$' for Canadian dollars.

PRODUCTION DATA

All capacity production data are in short tons of 2000 lb, unless specifically indicated as metric.

To convert to metric tons:
multiply by 0.90718

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UNITED STATES

INDUSTRY STRUCTURE

The U.S. paper and allied products industry ranks ninth among manufacturing industries in shipments, falling behind food, transportation equipment, machinery, petroleum, chemicals, primary metals, electrical equipment and fabricated metals in size. The industry's shipments of $77.7 billion in 1981 accounted for 3.8% of total U.S. manufacturing shipments, while its workforce of 687,000 employees amounted to less than 1% of the total U.S. nonagricultural payroll.

U.S. PAPER INDUSTRY VALUE OF SHIPMENTS RANKED WITH OTHER MANUFACTURING INDUSTRIES

($ billion)

	1981	1980	% change
Nondurable goods industries	$777,896	$909,903	7.5%
1. Food, kindred products	266,111	254,745	4.5
2. Petroleum & coal	194,703	176,598	10.2
3. Chemical & allied products	182,343	167,099	9.1
4. Paper & allied products	77,745	71,660	8.5
5. Rubber & plastics	46,640	48,060	− 3.0
6. Textile mill products	50,682	46,167	9.8
7. Tobacco	13,623	12,466	9.3
Durable goods industries	1,019,879	936,030	9.0
Transportaiton equip.	219,761	191,387	14.8
2. Machinery (except electrical)	204,644	182,837	11.9
3. Primary metals	137,970	134,051	2.9
4. Electrical machinery	136,583	125,907	8.5
5. Fabricated metals	123,117	116,868	5.3
6. Instruments & related	50,223	45,993	9.2
7. Stone, clay, glass	49,051	45,518	7.8

Source: Commerce Dept.

The largest U.S. paper/forest products company in sales in 1981 was Georgia-Pacific Corp. with revenues of $5.4 billion, followed by International Paper Co. with sales of $4.9 billion. This placed G-P in 98th place and International Paper Co. in 111th place in a *Forbes* magazine ranking of the 500 largest U.S. corporations in sales. To give some further perspective on the paper industry's size, Exxon, the largest U.S. corporation, had 1981 sales of $108 billion—larger than the entire paper and allied products industry.

About 44% of the industry's 1981 sales came from primary production of pulp, paper, and building board, with the remainder from converted products. Paper accounts for 57% of the primary sector's shipment value, while paperboard accounts for 31%, market pulp 10%, and building paper and board 1.6%. The converting side of the industry is fairly evenly divided between paper and paperboard converting, with corrugated containers, sanitary tissue, bags, and paper coating and glazing ranking highest in shipment value.

Concentration trends. Although still fairly fragmented, the North American paper industry is gradually becoming more concentrated. The 15 largest U.S. and Canadian companies in 1982 accounted for 56.9% of total North American woodpulp capacity, up from 52.2% a decade ago in 1973 when PULP & PAPER first began making such tabulations. Paper and paperboard capacity of the 15 largest companies climbed to 45.3% from 42.1% in 1973.

Even with the sale of its Canadian operations, International Paper was still the industry capacity leader by a wide margin, with 17,060 tpd of pulp and 16,286 tpd of paper/paperboard—7.3% and 6.5% of total North American industry capacity in 1982. Weyerhaeuser Co. was second in pulp with 11,515 tpd, while St. Regis Paper Co. is second in paper/paperboard with 11,279 tpd, and the same two companies occupy third place in these categories reversed.

Names in the top 15 producers have not changed significantly over the past decade. Abitibi, which did not appear in the 1973 list in pulp and was 15th largest in paper capacity, had jumped to 4th place in 1982 as a result of its merger with Price in the late 1970s. Champion International, which also did not appear on the 1973 list, is now 8th in pulp and 5th in paper/paperboard. Spun off from International Paper in 1981, CIP appears on the 1982 list as 10th in pulp and 15th in paper/paperboard. Companies that appeared on the 1973 list that have disappeared from the 1982 top 15 rankings include Scott Paper (formerly 11th), Mead (15th) and Domtar (7th) in pulp; and MacMillan Bloedel (formerly 8th) and Domtar (14th) in paper/board.

Economies of scale. The reasons for this gradual growth in concentration include the growing size of mills and machines which limits the ability of smaller companies to compete, and also rising energy, fiber, and environmental compliance costs which particularly hurt smaller, nonintegrated producers. This has resulted in a gradual merger trend in the industry and continuing shutdown of older facilities.

According to American Paper Institute data, the number of mills making paper and board declined from 687 in 1976 to 635 in 1980, even though annual capacity rose from 68.2 million tpy in 1976 to 70.7 million in 1980. Capacity at mills under 50,000 tpy

LEADING U.S. FIRMS

(1981 sales of $500,000,000 or higher)

Company	1981 sales	Paper/board capacity (rank)	Paper/board capacity (tpd)	Pulp capacity (rank)	Pulp capacity (tpd)
Georgia-Pacific	$5,414,000,000	15	4,264	6	8,236
International Paper	4,984,000,000	1	16,286	1	17,060
Weyerhaeuser	4,501,512,000	3	9,975	2	11,515
Champion International	4,004,017,000	4	7,980	7	7,330
Crown Zellerbach	3,148,300,000	5	7,965	4	8,361
Boise Cascade	3,107,360,000	8	7,339	5	8,355
Mead	2,899,700,000	6	7,862	14	4,387
St. Regis	2,818,798,000	2	11,279	3	9,601
Scott	2,309,444,000	10	5,755	12	5,045
Container Corp.	1,821,000,000	12	5,355	17	3,100
Union Camp	1,665,888,000	7	7,370	8	7,000
Westvaco	1,550,529,000	11	5,555	11	5,582
Great Northern Nekoosa	1,493,000,000	9	6,790	9	6,495
Hammermill	1,399,694,000	22	2,093	25	1,690
Time Inc.*	1,162,000,000	16	4,200	15	4,300
Continental Forest	1,121,000,000	13	4,575	13	4,520
Willamette	975,640,000	19	2,815	20	2,700
Potlatch	880,493,000	20	2,495	22	2,180
Bowater N.A.	836,000,000	14	4,500	10	6,205
Owens-Illinois*	824,000,000	17	3,590	16	3,490
Southwest Forest	779,461,000	24	2,020	18	2,880
James River	772,681,636	27	800	23	1,985
Packaging Corp. of America	650,000,000	18	3,390	21	2,320
ITT Rayonier	644,000,000	28	200	19	2,870
Manville Corp.*	554,612,000	23	2,040	26	1,670
Consolidated Papers	536,898,881	25	1,918	27	1,088
Sonoco	533,349,000	21	2,357	28	390
Federal Paper Board	520,347,000	26	1,732	24	1,850

* Sales of forest products group only, not corporate total

Source: Compiled from data in Company Profiles section declined by 13.0% over the period, while capacity at mills over 300,000 tpy rose 13.8%. Similarly, the number of woodpulp mills declined from 271 in 1976 to 248 in 1980, while capacity rose from 53.04 million tpy in 1976 to 55.2 million in 1980.

While paper and board capacity rose 3.7% from 1976-80, nonintegrated paper and board capacity declined 8.7% from 17.7 million to 16.2 million tons, accounting for 22.8% of total industry capacity in 1980 compared with 26.0% in 1976, the API data show.

Size distribution. The number of paper/board machines in the industry dropped from 1578 in 1975 to 1440 in 1980. The largest number of the 138 machines shut down were in uncoated free-sheet, thin papers, packaging/industrial converting papers and recycled paperboard.

API data on size distribution of machines in various grades show that many small machines still exist in the uncoated free-sheet, packaging and industrial, tissue and recycled paperboard segments of the industry. Of the 258 uncoated free-sheet machines in the industry in 1980, 208 had capacity below 50,000 tpy, while new machines currently being installed in the industry are typically between 150,000 and 200,000 tpy in size. Of 236 tissue machines in the industry, 136 were below 20,000 tpy of capacity, while new tissue machines are generally between 50,000 and 80,000 tpy. Although many of these small machines profitably serve special market niches, some will be vulnerable to efficient new machines being installed in the higher volume, commodity segments of these markets.

Market segments. Concentration in the paper industry is higher if individual market segments are examined. For example, ten companies account for about 65% of U.S. uncoated free-sheet capacity. But only four companies hold more than 50% of the bond/reprographic paper market (Great Northern Nekoosa, International Paper, Hammermill and Champion), while only three (Champion, Union Camp and IP) have more than half the envelope paper market. Five companies have about 69% of total U.S. tissue capacity, but Fort Howard Paper Co. alone is estimated to have more than 30% of the commercial/industrial segment of the market.

U.S. CAPACITY IN INTEGRATED AND NONINTEGRATED MILLS

(000 short tons)

	Annual paper & board capacity					
Grades	Integrated to woodpulp		Nonintegrated		Total	
	1980	1976	1980	1976	1980	1976
Total all grades	**54,560**	**50,482**	**16,156**	**17,702**	**70,716**	**68,184**
Paper	**26,061**	**21,360**	**6,598**	**7,851**	**32,659**	**29,210**
Newsprint	4,836	3,589	—	425	4,836	4,014
Uncoated groundwood	1,462	1,093	162	216	1,624	1,309
Coated groundwood	2,649	2,218	113	81	2,762	2,299
Coated free sheet	1,774	1,359	448	544	2,222	1,903
Uncoated free sheet*	6,910	4,837	1,874	2,624	8,784	7,461
Thin papers	103	57	279	301	382	358
Solid bleached bristols	874	1,092	150	73	1,024	1,165
Pkg. & ind. conv.	4,878	5,071	1,194	1,131	6,072	6,202
Tissue	2,575	2,043	2,379	2,457	4,954	4,500
Paperboard	**25,526**	**23,836**	**8,183**	**8,261**	**33,709**	**32,097**
Unbleached kraft	15,967	14,568	—	—	15,967	14,568
Solid bleached	4,180	3,998	—	—	4,180	3,998
Semichemical	4,946	4,758	—	—	4,946	4,758
Recycled	434	513	8,183	8,261	8,617	8,774
Construction paper & board†	**2,972**	**5,286**	**1,375**	**1,590**	**4,347**	**6,876**

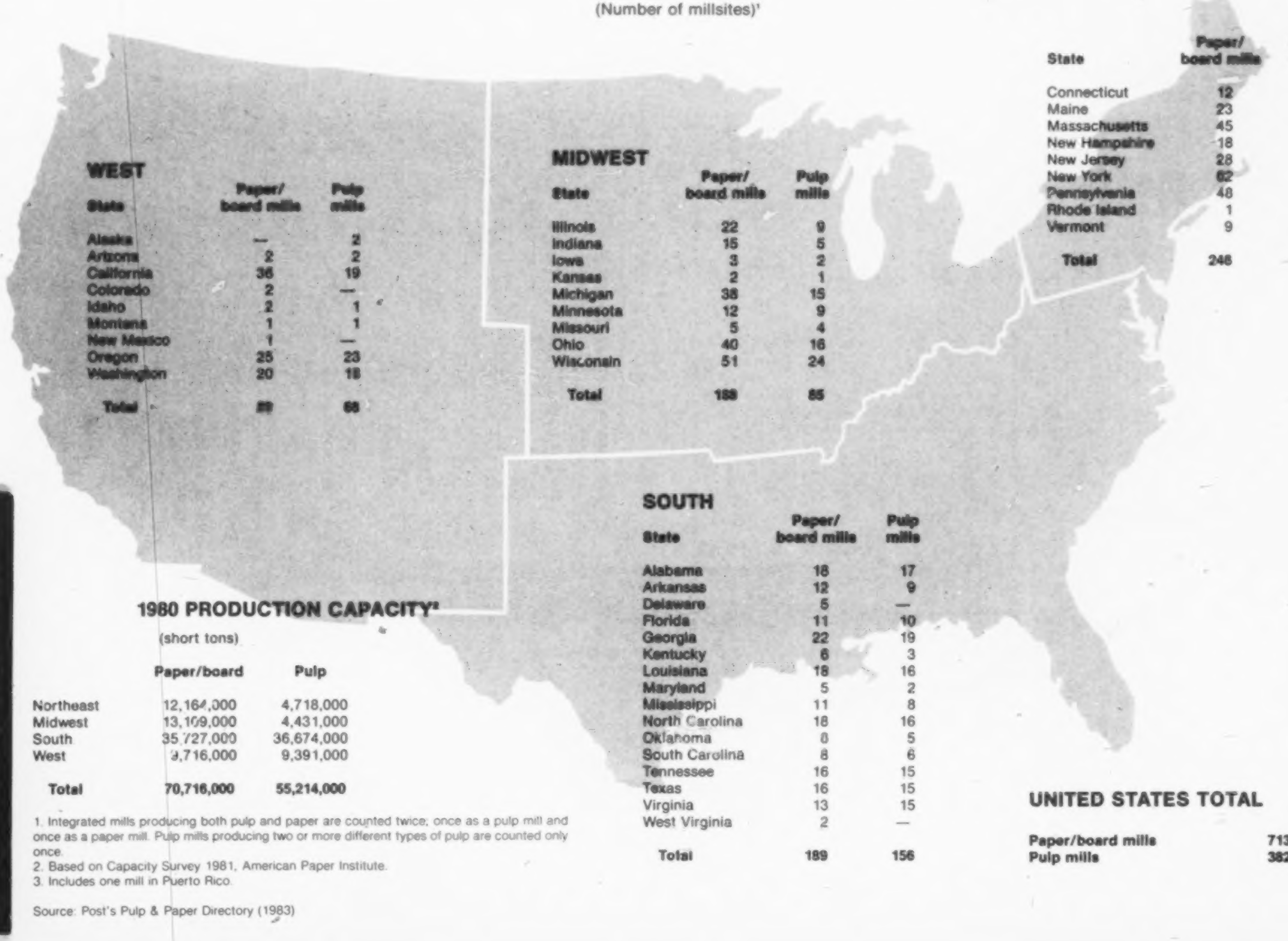
* Includes cotton fiber

† Includes hardpressed board in 1976 only

Source: American Paper Institute

NUMBER OF PULP, PAPER AND BOARD MILLS IN UNITED STATES, BY REGION

(Number of millsites)[1]



WEST

State	Paper/ board mills	Pulp mills
Alaska	—	2
Arizona	2	2
California	36	19
Colorado	2	—
Idaho	2	1
Montana	1	1
New Mexico	1	—
Oregon	25	23
Washington	20	18
Total	89	66

MIDWEST

State	Paper/ board mills	Pulp mills
Illinois	22	9
Indiana	15	5
Iowa	3	2
Kansas	2	1
Michigan	38	15
Minnesota	12	9
Missouri	5	4
Ohio	40	16
Wisconsin	51	24
Total	188	85

State	Paper/ board mills	Pulp mills
Connecticut	12	3
Maine	23	13
Massachusetts	45	3
New Hampshire	18	5
New Jersey	28	8
New York	62	24
Pennsylvania	48	15
Rhode Island	1	1
Vermont	9	2
Total	246	74

SOUTH

State	Paper/ board mills	Pulp mills
Alabama	18	17
Arkansas	12	9
Delaware	5	—
Florida	11	10
Georgia	22	19
Kentucky	6	3
Louisiana	18	16
Maryland	5	2
Mississippi	11	8
North Carolina	18	16
Oklahoma	8	5
South Carolina	8	6
Tennessee	16	15
Texas	16	15
Virginia	13	15
West Virginia	2	—
Total	189	156

1980 PRODUCTION CAPACITY[2]

(short tons)

	Paper/board	Pulp
Northeast	12,164,000	4,718,000
Midwest	13,109,000	4,431,000
South	35,727,000	36,674,000
West	9,716,000	9,391,000
Total	70,716,000	55,214,000

UNITED STATES TOTAL

Paper/board mills	713[3]
Pulp mills	382[3]

1. Integrated mills producing both pulp and paper are counted twice; once as a pulp mill and once as a paper mill. Pulp mills producing two or more different types of pulp are counted only once.
2. Based on Capacity Survey 1981, American Paper Institute.
3. Includes one mill in Puerto Rico.

Source: Post's Pulp & Paper Directory (1983)

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U.S. MILL SIZE DISTRIBUTION FOR PAPER/BOARD AND WOODPULP

Mill capacity range (000 tpy)	Paper & Paperboard				Woodpulp			
	Number of mills		Annual capacity (000 tpy)		Number of mills		Annual capacity (000 tpy)	
	1980	1976*	1980	1976*	1980	1976*	1980	1976*
TOTAL	**635**	**687**	**70,716**	**68,184**	**248**	**271**	**55,214**	**53047**
0- 25	205	238	2,647	3,043	30	32	467	487
26- 50	115	133	4,236	4,891	29	40	1,096	1,491
51- 75	70	72	4,386	4,500	19	26	1,189	1,620
76-100	42	52	3,681	4,606	17	20	1,546	1,779
101-125	43	32	4,866	3,565	12	15	1,381	1,688
126-150	16	18	2,247	2,506	9	13	1,505	1,724
151-175	15	23	2,613	3,714	14	13	2,301	2,094
176-200	20	17	3,935	3,194	10	9	2,106	1,682
201-250	23	20	5,415	4,440	19	20	4,147	4,330
251-300	13	17	3,543	4,608	17	12	4,438	3,270
301-350	15	19	4,853	6,081	7	13	2,569	4,212
351-400	18	11	6,722	4,171	13	13	4,872	4,971
401-450	12	11	5,063	4,617	13	15	5,454	6,397
451-500	8	6	3,773	2,888	14	8	6,637	3,858
Over 500	20	18	12,736	11,360	25	22	15,506	13,444

* 1976 includes mills and capacity for hardpressed board and supporting pulp facilities.

Source: American Paper Institute

MACHINES IN OPERATION IN THE U.S. PAPER INDUSTRY—BY GRADE IN 1975 AND 1980

	Number of machines		Machine capacity
	1980	1975	1980
All grades	**1,440**	**1,578**	**71,279**
Total paper	**919**	**981**	**32,373**
Newsprint	43	38	5,115
Uncoated groundwood	33	38	1,379
Coated papers	82	81	4,987
Uncoated free sheet*	258	278	8,909
Thin papers	45	62	386
Solid bleached bristols	17	16	1,056
Pkg. & ind. conv.	205	228	5,431
Tissue	236	240	5,110
Total paperboard	**360**	**395**	**34,284**
Unbleached kraft	74	69	16,594
Solid bleached	30	31	4,374
Semichemical	47	51	4,782
Recycled	209	244	8,534
Total other paper & board	**161**	**202†**	**4,622**

* Includes cotton fiber
† Includes hardpressed board in 1975 only

Source: American Paper Institute

PRODUCTION, EXPORTS/IMPORTS

U.S. paper and board production has suffered from the sluggish stop-and-go economic growth accompanied by high inflation and interest rates that have so far marked the decade of the 1980s. After reaching a peak of 64.6 million short tons in 1981, production dropped 1.3% during the 1980 recession year and then recovered by 1.1% in 1981 to 64.4 million tons. But another recession beginning in late 1981 and spilling over into 1982, accompanied by substantial inventory liquidation, appeared likely to cause production to drop between 5% and 6% to around 61 million tons for all of 1982.

With capacity rising at an average annual rate of 2.6% during this three-year period, industry operating rates have fallen from 93.6% in 1979 to 89.2% in 1981 and will probably average something like 81% to 82% for all of 1982—not much higher than the 79.2% low hit in the disastrous 1975 recession year which was also accompanied by heavy inventory reduction.

The negative 1.5%/year production growth so far this decade contrasts with a 2.2% average annual rate of increase during the 1970s, which was down from a 4.7%/year rate in the 1960s.

1981 production. Paper and paperboard production in 1981 set a new record—excluding construction grades hard hit by the severe downturn in home construction. Paper and paperboard output of 62.3 million tons was 1.8% above the 1980 level and 1.5% above the previous peak of 61.3 million tons set in 1979. (Construction paper/board grades and wet-machine board dropped by 16.7% in 1981 to 2.1 million tons which indicated that this segment was only operating at about 50% of capacity.)

Paper production tends to track general economic activity and is most closely tied to printing, advertising and the service sector of the economy. With real GNP showing a 2.0% rise for 1981, paper production set a new record of 31.0 million tons, up 2.8% from the previous year.

Among major paper grades, newsprint turned in the strongest performance, rising 12.1% to 5.2 million tons, after a 15.2% rise the preceding year. This reflected the startup of several new newsprint machines in the South and Pacific Northwest which displaced some tonnage previously imported from Canada. Printing/writing papers also reached a new high in 1981 of 15.5 million tons, up 1.0% higher from their 1981 level. Packaging and industrial paper grades, which have been under heavy competitive pressure from plastics, turned in the worst performance of any major paper segment, declining by 0.4% in 1981 to 5.6 million tons, following a 5.5% decline the previous year.

Paperboard as well as packaging and industrial paper grades tend to follow industrial production, which was up 2.6% in 1981. Paperboard output of 31.2 million tons in 1981 was up 0.9% from 1980 but 0.6% below its 1979 peak of 31.4 million tons. Unbleached kraft linerboard production rose 2.2% to 14.5 million tons in 1981, while semichemical medium was off 0.1% at 4.7 million tons. This performance, however, was helped by a substantial 745,000-ton rise in containerboard inventories at corrugated box plants and mills during 1981 which more than offset a sharp drop in exports. Solid bleached paperboard rose by 1.2% to 3.9 million tons in 1981, while recycled paperboard dropped by 1.0% to 7.1 million tons, following a drop of 6.9% the preceding year.

Total woodpulp production set a new record of 52.0 million short tons in 1981, up 2.5% from the 1980 level, although market pulp production declined by 4.6% to 6.2 million short tons.

EXPORTS/IMPORTS

U.S. paper industry exports (including pulp, wastepaper and converted products) fell by 9.9% to 10.7 million short tons in 1981 from 1980's record level of 11.8 million tons, reflecting recessionary conditions in major overseas markets, a strong dollar which made U.S. exports more expensive, and the fact that volume had jumped by a remarkable 31.9% the previous year. Lower exports to four major markets accounted for all of the drop, with shipments to Western Europe falling 494,000

U.S. PAPER & BOARD PRODUCTION BY MAJOR GRADE, 1982-78

	(000 short tons)					(Percent change)			
	1982*	**1981**	**1980**	**1979**	**1978**	**1982/81***	**1981/80**	**1980/79**	**1979/78**
PAPER									
Newsprint	5,240	5,239	4,672	4,062	3,768	+2.0%	+12.1%	+15.2%	+ 7.8%
Printing/writing	15,518	15,736	15,577	15,413	14,545	−3.4	+ 1.0	+ 1.1	+ 6.0
Uncoated groundwood (s)	1,399	1,463	1,498	1,509	1,309	−6.2	− 2.3	− 0.7	+15.2
Coated paper (s)	4,922	4,940	4,673	4,572	4,448	−0.5	+ 5.7	+ 2.2	+ 2.8
Uncoated free sheet (s)	7,803	7,888	8,016	7,823	7,225	−4.2	+ 2.5	+ 8.3	+ 8.3
Thin paper	351	336	333	372	354	−0.4	+ 0.9	−10.5	+ 5.1
Cotton fiber (s)	128	125	126	125	114	+0.6	− 0.9	+ 0.8	+ 9.7
Bleached bristols (s)	917	974	932	1,058	1,095	−9.0	+ 4.5	−11.9	− 3.4
Tissue paper	4,395	4,503	4,375	4,520	5,215	−3.1	+ 2.9	− 3.2	+ 7.2
Packaging & industrial converting (s)	5,269	5,556	5,576	5,885	5,789	−8.9	− 0.4	− 5.5	+10.9
Unbleached kraft paper (s)	3,656	3,773	3,962	4,098	3,884	−9.3	− 2.2	− 3.3	+ 5.5
Other paper	1,613	1,675	1,604	1,797	1,434	−7.8	+ 4.3	−10.5	+25.7
Total paper	30,423	31,078	30,195	29,850	28,484	−3.5	+ 2.8	+ 1.0	+ 5.0
PAPERBOARD									
Unbleached kraft linerboard	13,937	14,540	14,233	13,951	13,229	−7.9	+ 2.2	+ 2.0	+ 5.5
Other unbl. kraft paperboard	1,083	1,062	1,063	1,200	1,145	−6.9	− 0.1	−11.4	+ 4.8
Semichemical paperboard	4,488	4,723	4,719	4,689	4,439	−9.0	+ 0.1	+ 0.6	+ 4.8
Solid bleached	3,801	3,910	3,862	3,998	3,979	−6.5	+ 1.2	− 3.5	+ 5.6
Recycled	6,773	7,601	7,071	7,591	7,485	−7.8	− 1.0	− 6.9	+ 0.5
Total paperboard	30,073	31,232	30,952	31,429	30,275	−7.8	+ 0.9	− 1.5	+ 1.4
TOTAL PAPER & BOARD	60,495	62,260	61,147	61,319	58,733	−5.7	+ 1.8	− 0.3	+ 3.8
CONSTRUCTION & WET MACHINE	n.a.	2,129	2,558	3,275	3,476	n.a	−16.7	−21.9	− 5.8
TOTAL PAPER & BOARD	n.a.	64,389	63,701	64,594	62,109	n.a.	− 1.1	− 1.3	+ 4.0

INDICATED OPERATING RATES FOR MAJOR GRADE SEGMENTS

	(production/annual capacity)				
PAPER					
Newsprint	93.9%	98.9%	96.6%	96.7%	91.8%
Printing/writing	86.2	90.8	92.7	96.0	93.4
Tissue	86.7	89.0	88.3	92.8	90.8
Packaging & indus. converting	85.8	93.3	91.7	97.4	94.2
Total paper	87.1	92.2	93.1	95.9	93.4
PAPERBOARD					
Unbleached kraft	86.2	97.7	95.8	97.5	95.5
Semichemical paperboard	86.7	95.4	95.4	96.4	93.7
Solid bleached board	92.8	97.4	92.4	93.7	94.8
Recycled paperboard	78.4	81.5	82.1	86.7	86.6
Total paperboard	84.9	91.2	91.8	94.0	92.7
TOTAL PAPER/PAPERBOARD	86.0	91.7	92.1	94.9	93.1
CONSTRUCTION & WET MACHINE	n.a.	49.9	58.8	74.1	80.3
TOTAL PAPER & BOARD	n.a.	88.9	90.1	93.6	92.3

tons to 2.99 million tons, shipments to Mexico off 357,000 tons to 960,000 tons, and exports to Japan down 277,000 tons to 1.1 million tons. Exports to People's Rep. of China, which in 1980 emerged as a significant importer of U.S. paper products, fell from 600,000 tons to 394,000 tons in 1981.

Woodpulp exports declined by 3.4% to 3.7 million short tons in 1981, while wastepaper exports dropped 17% to 2.2 million tons. Paper, paperboard and converted products declined by 11% to 4.6 million tons. Kraft linerboard, the largest single paper/board export grade, dropped 21.9% to 1.97 million tons in 1981, partly reflecting a sharp dropoff in shipments to the People's Rep. of China. Bleached paperboard exports, which largely consist of milk carton stock, rose 16.8% to 368,000 tons. Newsprint exports jumped 54% to 270,000 tons, reflecting addition of a second machine at North Pacific Paper in Longview, Wash., which exports about half of its output to Japan.

U.S. paper industry imports (including pulp, wastepaper and converted) declined by 3.2% to 12.6 million tons in 1981, following a 4.5% decline in 1980. Woodpulp imports, mainly from Canada, rose by 0.9% to 4.1 million tons, but were still below their 1979 peak of 4.3 million tons.

Imports of paper, board and converted products dropped 4.4% in 1981 to 7.9 million tons, following a 5.0% drop in 1980 and a 0.5% decline in 1979 from the 1978 peak of 8.8 million tons. Newsprint, the largest paper/board import category, declined by 4.1% to 6.98 million tons as output from several new U.S. machines displaced shipments from Canada. This continues a trend in which growing domestic output has caused Canada's share of total U.S. newsprint supply to decline from 70% in 1962 to 64% in 1972 and 57.5% in 1981. Printing/writing paper imports dropped by 13.6% to 639,000 tons in 1981 as new domestic capacity replaced higher-priced imports from Europe that entered the U.S. market during a period of tightness in 1978-79.

Because U.S. paper exports have been growing more rapidly than imports, the industry's net trade deficit—caused mainly by heavy newsprint and pulp imports from Canada—has been narrowing. The total industry trade deficit in 1981 amounted to 1.9 million tons

U.S. WOODPULP PRODUCTION BY MAJOR GRADES, 1982-78

(000 metric tons)

	1982	1981	1980	1979	1978
TOTAL WOODPULP					
Bleached Sulfite	n.a.	1,272	1,324	1,250	1,289
Unbleached sulfite	n.a.	362	349	359	300
Total sulfite	n.a.	1,635	1,673	1,608	1,588
Bl. & semibl. softwood sulfate	n.a.	10,551	9,868	9,360	9,026
Bl. & semibl. hardwood sulfate	n.a.	7,647	7,369	7,024	6,499
Total bl. & semibl. sulfate	n.a.	18,198	17,236	16,384	15,521
Total white pulp	n.a.	19,833	18,909	17,992	17,113
Unbleached sulfate	n.a.	17,702	17,773	17,763	17,221
Total chemical paper-grade	39,588	37,535	36,683	35,755	34,376
Semichemical	3,523	3,560	3,652	3,681	3,432
Mechanical	4,687	4,826	4,324	3,984	3,756
Total paper-grade	45,171	45,920	44,657	43,421	41,564
Dissolving, special alpha	1,096	1,239	1,368	1,358	1,280
Total woodpulp	46,267	47,160	46,028	44,779	42,884
MARKET PULP					
Chemical paper-grade	4,356	4,402	4,457	3,733	3,306
Groundwood, other	0	1	62	57	69
Dissolving	1,086	1,213	1,366	1,361	1,275
Total market pulp	5,442	5,615	5,886	5,151	4,650
OPERATING RATES					
Total white pulp	n.a.	98.9%	96.9%	95.4%	92.9%
Total paper-grade	n.a.	91.8	92.4	91.6	88.7
Dissolving/special alpha	n.a.	86.5	95.5	92.8	86.1

* Annual rate for first half of 1982.

Source: American Paper Institute

HISTORICAL U.S. PAPER AND PAPERBOARD PRODUCTION, IMPORTS, EXPORTS AND APPARENT CONSUMPTION 1982-50

	Production[1]	Imports[1]	Exports[1]	Apparent consumption[2]	Real GNP (billion 1972$)	Ratio consumption to real GNP (000 tons/bil.$)	Population (millions)	Per capita consumption (lb/capita)
1982								
2nd	57,757[3]	7,724	4,279	61,202	1,476.8	41.44	231.5[4]	544.0[4]
1st	60,982[3]	7,789	4,091	64,680	1,470.7	43.98	—	—
1981	62,260	7,942	4,561	65,641	1,502.6	43.68	229.7	571.5
4th	60,066[3]	8,344	3,999	64,411	1,490.1	43.23	—	—
3rd	63,321[3]	7,263	4,465	66,119	1,510.4	43.78	—	—
2nd	62,577[3]	8,067	5,038	65,606	1,502.2	43.67	—	—
1st	63,284[3]	8,095	4,743	66,636	1,507.8	44.19	—	—
1980	61,147	8,304	5,148	64,303	1,474.0	43.62	227.7	564.8
1979	61,271	8,738	3,610	66,399	1,479.4	44.88	225.1	590.0
1978	58,744	8,781	3,301	64,224	1,438.6	44.64	222.6	557.0
1977	56,823	7,293	3,171	60,945	1,369.7	44.50	220.2	553.5
1976	55,150	7,042	3,388	58,804	1,298.2	45.30	218.0	539.5
1975	48,147	6,165	3,050	51,262	1,233.9	41.54	216.0	474.6
1974	55,926	7,970	3,720	60,176	1,248.0	48.22	213.9	562.7
1973	56,383	8,019	2,965	61,437	1,255.0	48.95	211.9	579.9
1972	53,886	7,567	3,019	58,434	1,185.9	49.27	209.9	556.8
1971	49,782	7,319	3,076	54,025	1,122.4	48.13	207.7	520.2
1970	48,758	7,057	2,780	53,035	1,085.6	48.85	205.1	517.2
1969	49,853	7,210	2,702	54,361	1,087.6	49.98	202.7	536.4
1968	47,110	6,792	2,587	51,315	1,058.1	48.50	200.7	511.4
1967	43,745	6,916	2,053	48,608	1,011.4	48.06	198.7	489.3
1966	43,904	7,327	1,903	49,328	948.8	51.99	196.6	501.8
1965	40,489	6,549	1,736	45,302	929.3	48.75	194.3	466.3
1964	39,066	6,154	1,661	43,559	876.4	49.70	191.9	454.0
1963	35,914	5,637	1,302	40,249	832.5	48.35	189.2	425.5
1962	34,407	5,719	1,154	38,922	800.3	48.63	186.5	417.4
1961	32,548	5,663	1,175	37,036	756.6	48.95	183.7	403.2
1960	31,221	5,610	990	35,841	737.2	48.62	180.7	396.7
1955	26,772	5,313	805	31,280	657.5	47.57	165.9	377.1
1950	21,563	4,973	337	26,199	534.8	48.99	152.3	344.0

1. Excludes wet machine board, construction paper and board, and hard pressed board.
2. Apparent consumption (new supply) = production + imports − exports.
3. Quarterly production data at seasonally adjusted annual rates.
4. Annual rate for first half.

Source: American Paper Institute, Dept. of Commerce

($553 million), up from the low of 1.1 million tons ($296 million) reached in 1980 but considerably less than the 4.6 million-ton ($1.4 billion) trade gap shown in 1979 and 6.1-million ton ($632 million) deficit a decade earlier in 1972.

U.S. exports of paper/board and converted products grew at a 5.3% annual rate during the decade that ended in 1981, while import tonnage increased at a 1.5% pace. Because of lower production costs and greater fiber availability in the U.S., this trend is expected to continue, with the total U.S. paper industry trade deficit possibly disappearing in the late 1980s.

Apparent consumption. Apparent U.S. paper and paperboard consumption (defined as production plus exports minus imports) rose 2.1% to 65.6 million tons in 1981 from the previous year, but was still 1.1% below the peak of 66.4 million tons reached in 1979 (excluding construction grades).

The ratio of apparent consumption per billion dollars of real GNP remained relatively stable in 1981 at 43,680 tons, but in the second quarter of 1982 declined sharply to 41,440 tons, near the low of 41,540 tons reached in the 1975 recession, and probably reflected inventory liquidation. Before the last major recession, the ratio averaged around 48,000 and 49,000 tons, but since the 1975 downturn apparent consumption has averaged about 43,000 to 44,000 tons/billion dollars of real GNP. This decline probably reflects a permanent reduction in demand caused by a sharp rise in paper prices in 1974-75 and some plastic substitution for paper in the packaging segment of the industry.

Recession impact. The latest recession began to affect the U.S. paper industry in the fourth quarter of 1981, with paper and paperboard production dropping to a seasonally adjusted annual rate of 60.1 million tpy from 63.3 million tpy in the third quarter. Production recovered slightly in the first quarter of 1982 to a 61.0-million-tpy rate, but then fell to 57.8 million tpy in the second quarter, 5.3% below the first-quarter level and 8.8% below the cyclical high reached in the third quarter of 1981.

The recession has had less of an impact on paper grades which are more closely tied to the service sector of the economy and less affected by business cycles, with output for first-half 1982 down 3.5%. Among major grades, however, only newsprint continued to exceed its year-ago level with six-month production up 2%. Printing/writing paper shipments were down 3.4% from year-ago levels, with coated papers showing the greatest strength, reflecting substantial new capacity. Packaging and industrial grades were down sharply, with the six-month total 9% below year-ago levels.

HISTORICAL U.S. WOODPULP PRODUCTION, CAPACITY AND OPERATING RATES

(000 metric tons)

	Production*				
	Total	Captive	Market	Total* capacity	Operating rate
1981	47,160	41,545	5,615	49,812	95%
1980	46,028	40,142	5,886	48,536	95
1979	44,781	39,631	5,151	47,328	95
1978	43,032	38,385	4,647	46,018	94
1977	42,319	37,961	4,358	45,688	93
1976	41,187	36,774	4,413	44,653	92
1975	36,838	32,885	3,953	43,635	84
1974	40,676	36,014	4,663	41,352	98
1973	41,084	36,617	4,468	42,718	96
1972	39,544	34,985	4,559	41,191	96
1971	37,211	33,008	4,204	40,402	92
1970	37,050	32,110	4,941	39,538	94
1965	28,855	25,369	3,486	30,989	93
1960	21,755	19,038	2,717	25,646	85
1955	17,570	15,141	2,429	18,955	93
1950	12,447	10,933	1,454	13,622	91

* Includes paper-grade, dissolving/special alpha pulps, but excludes defibrated/exploded pulps, screenings and fiber other than wood.

Source: API Pulp & Raw Materials Group

Paperboard output, however, closely followed the sharp drop in industrial production, plunging 7.8% for the first six months. The decline was fairly evenly spread across the major paperboard grades, with linerboard output down 7.9%, semichemical medium off 9.0%, solid bleached paperboard down 6.5% and recycled paperboard down 7.8%. Exports of linerboard were down 4.3%, while solid bleached board overseas shipments were off 2.7%.

Total woodpulp production for the first five months of 1982 was down about 4.3%, while market pulp output fell 4.7%, the latter a fairly strong performance in a recession year, reflecting aggressive marketing by southern producers and increasing inventories.

Paper industry exports (including pulp, wastepaper and converted products) were down 12.1% for the first five months, hurt by the strong U.S. dollar and continuing recession overseas, while imports were down 10.5% for the same period.

With only a modest economic recovery expected in

HISTORICAL U.S. PAPER AND BOARD PRODUCTION, CAPACITY AND OPERATING RATES, 1982-60

			Production			Capacity		Oper. rate
	Paper	Paper board	Construction & wet machine	Total paper/board	Total % change	paper/board	Total % change	paper/board
1982e	30,100	29,700	1,800	61,600	− 4.3%	74,558	+3.3%	82.6%
1981	31,028	31,232	2,114	64,374	+ 1.1	72,148	+2.0	89.2
1980	30,195	30,952	2,558	63,705	− 1.4	70,716	+2.4	90.1
1979	29,890	31,429	3,275	64,594	+ 3.8	69,033	+2.4	93.6
1978	28,458	30,275	3,476	62,208	+ 3.3	67,419	+1.4	92.1
1977	27,870	28,953	3,384	60,207	+ 2.9	66,459	+1.2	89.9
1976	26,608	28,440	3,335	58,486	+14.4	65,673	+2.0	89.0
1975	23,391	24,756	2,979	51,126	−13.6	64,369	+0.9	79.2
1974	27,011	28,915	3,284	59,210	− 1.2	63,779	+2.4	92.7
1973	26,811	29,571	3,554	59,936	+ 4.3	62,284	+3.9	96.3
1972	25,383	28,502	3,592	57,477	+ 8.0	59,965	+3.1	95.8
1971	23,745	26,037	3,421	53,203	+ 2.9	58,190	+1.7	91.5
1970	23,375	25,383	2,952	51,710	− 2.4	58,022	+2.2	90.4
1969	23,477	26,376	3,103	52,956	+ 5.5	57,035	+1.7	92.8
1968	22,206	24,904	3,062	50,172	+ 7.7	54,913	+4.2	91.4
1967	20,926	22,819	2,823	46,568	− 0.3	52,718	+5.0	88.3
1966	20,725	23,179	2,798	46,702	+ 7.5	50,210	+6.9	93.0
1965	19,157	21,332	2,966	43,455	+ 6.1	46,980	+3.9	92.5
1964	18,112	19,954	2,896	40,962	+ 6.0	45,200	+3.4	90.6
1963	17,320	18,594	2,733	38,647	+ 4.3	43,712	+3.5	88.4
1962	16,560	17,847	2,655	37,062	+ 5.3	42,250	+0.5	87.7
1961	15,821	16,727	2,630	35,187	+ 3.8	42,038	+3.4	83.7
1960	15,295	15,926	2,683	33,904	+ 0.5	40,648	+2.9	83.4
Average annual change								
1982-80					− 1.5%		+2.6	
1979-70					+ 2.2		+2.1	
1969-60					+ 4.7		+3.5	

1. Excludes hardpressed board.

Source: American Paper Institute (Bureau of Census for total paper/board production usually lower (000 tons): 1980—63,864; 1979—62,752; 1978—62,006; 1977—60,485; 1976—57,788).

the second half of 1982, paper industry production was expected to remain weak as producers take heavy downtime to reduce excessive inventories of such key grades as containerboard, newsprint and market pulp. Production is expected to show a sharp drop against year-ago levels in the third quarter of 1982, but may begin to rise in the fourth quarter when compared against the depressed final quarter of 1981.

Although forecasts of 1983 economic growth are highly speculative, some analysts forecast U.S. paper and board production will rise between 5% to 7% in 1983—not a strong recovery from such a severe recession but still a welcome improvement from the industry's performance so far this decade.

INVENTORY LEVELS FOR PULP, NEWSPRINT AND CONTAINERBOARD

	Norscan producer[1] pulp stocks	**U.S. consumer newsprint stocks**		**U.S. container-board inventories**	
	(000 metric tons)	**(000 metric tons)**	**(days)**	**(000 short tons)**	**(weeks)**
1982					
June	1873	1564	61	2634	7.9
Mar	1172	1671	59	2570	7.4
1981					
Dec	1430	1477	56	2729	9.4
Sept	1146	1460	49	2451	6.6
June	1026	1395	54	2368	6.7
Mar	1182	1286	45	2104	5.7
1980					
Dec	948	1090	42	1984	6.2
Sept	830	1212	40	2101	5.8
June	743	1192	47	2248	7.0
Mar	728	1058	38	1890	5.4
Year end					
1979	614	877	34	1979	6.2
1978	879	970	38	1961	5.8
1977	2223	1071	43	2437	7.2
1976	2825	1209	52	2527	8.1
1975	2011	911	44	2185	7.2
1974	611	1061	48	2323	8.2
1973	629	757	32	1595	4.7
1972	1149	667	26	1603	5.1
1971	1618	885	38	1639	5.7
1970	647	944	42	1879	7.0
Year-end average					
1970-71	1321	935	40	2013	6.5

1. Chemical paper-grade market pulp stocks at North American/Scandinavian producer mills (source: American Paper Institute).
2. Estimated U.S. publisher stocks of newsprint and days of supply (source: Canadian Pulp & Paper Assn.).
3. Containerboard inventories at box plants and mills and weeks of supply (source: Fibre Box Assn.).

TOP U.S. STATES IN PULP, PAPER AND PAPERBOARD PRODUCTION, 1980

(000 short tons)

PULP		PAPER		PAPERBAORD	
1. Georgia	5644	1. Wisconsin	3491	1. Georgia	4010
2. Alabama	4583	2. Maine	3230	2. Louisiana	2100e
3. Louisiana	3867	3. Washington	2000	3. Florida	2027
4. Florida	3578	4. Alabama	1806	4. South Carolina	1928
5. Washington	3426	5. New York	1750	5. Virginia	1764
6. Oregon	2980	6. Louisiana	1513	6. Oregon	1538
7. South Carolina	2474	7. Oregon	1458	7. California	1192
8. Maine	2293	8. Pennsylvania	1408	8. Ohio	1070
9. Mississippi	2269	9. Georgia	1213	9. North Carolina	1068
10. Virginia	2135	10. Michigan	1114	10. Tennessee	1006

e = estimate

Source: Bureau of the Census

U.S. PAPER INDUSTRY EXPORT TONNAGE BY AREAS OF DESTINATION

(% distribution)

	1981	1972
	Paper, paperboard and converted products	
Western Europe	20.6%	41.0%
Canada	15.0	13.6
Mexico	8.7	4.2
Central Amer. & Carribean	10.7	13.5
South America	8.0	8.1
Middle East & Africa	12.1	8.9
Japan	9.1	1.0
Oceania & Far East	11.1	9.1
Other	4.6	0.6
Total (short tons)	**4,641,054**	**3,103,738**
	Woodpulp	
Western Europe	48.5	47.4
Canada	3.2	4.6
Mexico	5.1	3.1
Central Amer. & Carribean	0.7	1.0
South America	4.2	10.2
Middle East & Africa	5.8	4.0
Japan	16.8	16.5
Oceania & Far East	10.6	10.7
Other	5.2	2.5
Total (short tons)	**3,677,635**	**2,252,778**

Source: API; Dept. of Commerce

U.S. PAPER INDUSTRY EXPORTS, IMPORTS AND NET TRADE BALANCE

	1981		1980		1979		1972	
	Tons (000)	Value ($ million)	Tons (000)	Value ($ million)	Tons (000)	Value ($ million)	Tons (000)	Value ($ million)
Exports								
Woodpulp	3,678	$1,661	3,806	$1,652	2,935	$1,104	2,253	$ 358
Paper	1,009	847	907	737	601	508	558	243
Newsprint	270	140	175	86	71	32	144	20
Printing/writing	383	355	341	306	275	233	171	210
Packaging, tissue, other	355	353	392	345	255	243	204	97
Paperboard	2,946	1,196	3,609	1,283	2,447	790	2,299	328
Linerboard	1,973	660	2,527	790	1,645	435	1,877	235
Bleached paperboard	584	368	606	315	509	239	209	47
Other paperboard	389	168	476	178	293	116	213	46
Total paper/paperboard	3,954	2,042	4,516	2,020	3,048	1,298	2,857	571
Converted products	607	811	632	720	562	586	161	105
Construction & wet machine	80	38	66	32	61	31	85	20
Wastepaper	2,213	269	2,664	322	2,233	256	415	21
Total industry exports	10,663	4,906	11,832	4,840	8,972	3,348	5,827	1,089
Imports								
Woodpulp	4,087	$1,754	4,051	$1,684	4,318	$1,465	3,728	$ 494
Paper	7,716	3,248	8,109	3,060	8,560	2,896	7,520	1,138
Newsprint	6,977	2,825	7,279	2,638	7,223	2,300	7,101	1,056
Printing/writing	639	347	740	363	1,179	512	258	48
Packaging, tissue, other	101	76	90	59	158	84	149	24
Paperboard	131	35	98	26	82	19	8	2
Total paper/paperboard	7,847	3,283	8,207	3,086	8,642	2,915	7,528	1,140
Converted products	95	310	95	251	96	223	39	33
Construction & wet machine	398	79	476	84	385	69	465	42
Wastepaper	79	13	87	17	78	11	133	12
Total industry imports	12,561	5,459	12,958	5,136	13,563	4,698	11,894	1,721
Net trade balance (deficit)								
Woodpulp	(409)	$ (93)	(245)	$ (32)	(1,383)	$ (361)	(1,475)	$ (136)
Paper/paperboard	(3,893)	(1,241)	(3,691)	(1,066)	(5,594)	(1,617)	(4,671)	(569)
Total industry	(1,898)	(553)	(1,126)	(296)	(4,591)	(1,350)	(6,067)	(632)

Source: API; Dept of Commerce

PRICES

The recession began to cause serious erosion in U.S. paper industry pricing in the fourth quarter of 1981, with discounting spreading through such key grade segments as market pulp, linerboard, uncoated free-sheet and kraft packaging papers. The price weakness continued into the third quarter of 1982, with many grades selling below year-earlier levels, and not much firming in pricing expected until the first half of 1983 when rising demand begins to pull up operating rates. The result has been a serious squeeze in profit margins, which along with red ink from wood products operations, probably caused industry profits to fall more sharply in 1982 than in the 1974-75 recession, when production dropped more sharply.

The deceleration in paper industry prices in the current recession is reflected in the Bureau of Labor Statistics price index for pulp, paper and converted products which rose 13.8% in 1980, then by 8.1% in 1981 and by only 3.6% in the first half of 1982 from year-earlier levels. These gains slightly lagged the BLS index for all industrial commodities which jumped 16.3% in 1980, 10.7% in 1981 and by only 3.6% for the first half of 1982.

By contrast, the 1974-75 recession followed a period of sharp price escalation caused by the lifting of price controls, and this helped cushion industry profits despite a somewhat sharper downturn in production. The price index for pulp, paper and converted products rose 24.7% in 1974 and 12.5% in 1975 but then slowed for the next three years due to weakness in pulp prices.

Woodpulp roller coaster. Pulp prices tend to be highly cyclical because of the tendency of integrated producers to become net sellers in weak markets and net buyers in strong markets, causing sharp fluctuations in supply and demand. The BLS index for woodpulp rose by nearly 100% during the 1974-75 period then flattened in 1976 before dropping almost 7% during the 1977-78 downturn in the world pulp market which was marked by heavy inventory liquidation. Prices then began to advance sharply, rising 17.9% in 1979 and 21.0% in 1980 before slowing to a 4.4% rise in 1981 and a 2.7% increase through the first half of 1982 from year-earlier levels.

The BLS indexes do not appear to fully reflect the extent market pulp transaction and spot prices have eroded from list levels. After reaching a low of around $330/ton in the last pulp market downturn, northern bleached softwood kraft pulp list prices began rising in the fourth quarter of 1978 and climbed for about seven consecutive quarters until reaching $545/metric (c.i.f. northern Europe) in the second quarter of 1980. Several further attempts to raise prices since then proved unsuccessful, and northern softwood prices began to erode in the late spring of 1982, reaching $465/metric ton at the begining of the third quarter.

Discounting began earlier and was even more severe in such grades as southern bleached softwood and hardwood kraft, with a more than $100/ton price gap with northern softwood probably encouraging some substitution of these shorter fiber grades.

Paper—best performance. Paper pricing has shown the best performance during the recession, with the BLS index rising 11.8% in 1980, 9.0% in 1981 and 5.4% through the first half of 1982, but may show weakness in the second half of 1982 and 1983 due to overcapacity in newsprint and coated groundwood papers. Newsprint producers last raised U.S. prices to $453/short ton in the summer of 1981 but were unsuccessful in pushing another increase through in the first half of 1982, with prospects for the next increase uncertain. Coated groundwood prices have advanced sharply since the 1974-75 recession, but have flattened out since the last price increase in the second quarter of 1981 and may be subject to greater discounting pressure in the second half of 1982 due to the startup of three new machines.

Uncoated free-sheet paper prices, especially commodity grades such as forms bond and reprographic, have been under heavy pressure. Spot discounts of $100/ton from list price levels in effect a year earlier have been not uncommon during most of 1982. The weakest paper segment in 1982 was unbleached kraft packaging paper.

SELECTED U.S. PULP, PAPER AND CONVERTED PRODUCT PRICES

	$/short ton domestic market—unless otherwise indicated					Percentage change from a year ago			
	7/82	1/82	1/81	1/80	1/79	7/82	1/82	1/81	1/80
PULP									
Bleached softwood kraft—Northern	$445*	$513	$481	$440	$358	− 7.5%	+ 6.7%	+ 9.2%	+22.7%
Bleached softwood kraft—Southern	380*	465*	465	425	335	−18.2	—	+ 9.4	+26.9
Bleached hardwood kraft—Southern	330*	440	440	400	315	−25.4	—	+10.6	+27.0
PAPER									
Newsprint (30 lb-East)	453*	453	426	375	345	+ 3.0	+ 6.3	+13.6	+ 8.7
Directory (22.5 lb white)	650	578	578	487	420	+12.4	—	+ 9.9	+15.9
Coated publication paper									
No. 1 (+70 lb sheets)	1130	1130	1038	998	900	+ 4.1	+ 8.9	+ 4.0	+10.9
No. 5 (32-36 lb rolls)	760*	760	735	669	605	—	+ 3.4	+ 9.9	+10.6
Uncoated free-sheet									
Book paper (No. 3 offset, +45 lb sheets)	878*	878*	813	717	648	—	+ 8.0	+13.4	+10.1
No. 1 (watermarked, +20-lb sheets)	867*	916*	848	778	692	—	+ 8.0	+ 9.0	+12.4
Forms bond (15-lb rolls)	753*	753*	697	620	550	—	+ 8.0	+12.4	+12.7
Tissue (BLS index)	350	350	342	292	266	—	+ 2.3	+17.1	+ 9.8
Unbleached kraft shipping sack (+50 lb)	380*	405	370	345	300	− 6.2	+ 9.5	+ 7.2	+15.0
PAPERBOARD									
Unbleached kraft linerboard (42-lb East)	270*	270*	300	270	220	−10.0	−10.0	+11.1	+22.7
Semichemical medium (26-lb East)	260*	260*	290	260	210	−10.3	−10.3	+11.5	+23.8
Folding boxboard									
Clay-coated recycled (20-pt rolls)	425*	425*	400	355	315	+ 2.9	+ 6.3	+12.7	+12.7
Solid bleached sulfate (15 pt, C1S, 80 brite, rolls)	625*	625*	550	490	445	+ 5.9	+13.6	+12.2	+10.1
CONSTRUCTION GRADES									
Insulation board (½-in./100ft²)	88.47	86.90	81.14	64.75	n.a.	+ 3.0	+ 7.1	+25.3	n.a.
CONVERTED PRODUCTS									
Corrugated price trend (FBA index)	n.a.	39.05	36.00	33.45	29.32	n.a.	+ 8.4	+ 7.6	+14.1

* = Discounting below list prices.
— = no change.

Source: Pulp & Paper Week, Bureau of Labor Statistics, Fiber Box Assn.

Grocery sack paper has been subject to discounts of 10% or more since the fall of 1981 due to competition from linerboard machines swinging into production of heavier kraft paper grades. Multiwall kraft sack paper has also been discounted $25/ton since April 1982, reflecting weakness in such key markets as construction and agriculture.

Paperboard—discounting hurts. Paperboard pricing rose 16.1% in 1980, 20.0% in 1981 and 1.7% through the first half of 1982, according to BLS indexes. Kraft linerboard has been particularly weak in the current recession, with $30/ton rebating bringing the effective price of linerboard in the eastern half of the U.S. to $270/ton for much of 1982, a level which analysts say is close to break-even for at least half the industry. Linerboard may not return to its former $300/ton list price level—first reached at the beginning of 1981—until early 1983, but then prices are expected to rise rapidly until new capacity is added in this grade. Solid bleached folding boxboard has been somewhat stronger, although there has been discounting in this grade in the East partly due to competitive pressure from clay-coated recycled boxboard mills that have benefited from the sharp decline in wastepaper prices.

Converted products. The converted products price index rose 13.8% in 1980, 8.5% in 1981 and 3.8% in the first half of 1982 from year-earlier levels, according to BLS. Discounting in containerboard has been placing increasing pressure on corrugated container prices, with the index for July 1.3% below year earlier levels and some industry sources saying deterioration has been more severe. There has also been significant weakness in converted bag and sack prices, although such bleached paperboard products as milk cartons, paper cups and ice cream cartons have held up better.

Wastepaper prices tend to be highly volatile, with the BLS index dropping by 15.8% in 1981 and 31.9% in 1982. Weakness showed up first in such lower grades as waste newspapers and old corrugated boxes, then spread to higher pulp substitute and deinking grades.

PRICE INDEXES FOR U.S. PULP, PAPER & PRODUCTS vs ALL INDUSTRIAL COMMODITIES

(1967 = 100)

	All industrial commodities	Pulp, paper & products*	Woodpulp	Wastepaper	Paper	Paper board	Converted products
1982 1st half	310.8	276.1	402.6	126.3	287.5	259.7	204.8
% change	+ 3.6%	+ 3.4%	+ 2.7%	−31.9%	+ 5.4%	+ 1.7%	+ 3.8%
1981	304.1	270.8	397.1	175.7	279.8	258.1	258.8
% change	+ 10.7%	+ 8.1%	+ 4.4%	− 15.8%	+ 9.0%	+ 10.0%	+ 8.5%
1980	274.8	250.6	380.3	208.7	256.8	234.6	238.5
% change	+ 16.3%	+ 13.8%	21.0%	+ 1.0%	+ 11.8%	+ 16.1%	+ 13.8%
1979	236.3	220.2	314.3	206.6	229.7	202.1	209.6
1978	209.4	195.5	266.5	191.2	206.1	179.4	186.3
1977	195.1	187.4	281.1	187.2	194.3	176.5	176.5
1976	182.3	180.8	286.0	184.9	182.2	176.3	170.0
1975	171.5	171.9	283.4	110.2	172.9	170.3	161.8
1974	153.8	152.8	217.8	265.5	148.6	152.2	144.9
1973	125.9	122.5	128.3	197.4	121.4	115.1	121.6
1972	117.9	113.7	111.5	133.6	116.3	105.5	113.6
1971	114.0	110.4	112.0	112.1	114.1	102.4	109.7
1970	110.0	108.5	109.5	125.0	111.0	101.1	107.9
Average annual rate 1970-79	+ 8.4%	+ 8.0%	+ 13.8%	+ 12.3%	+ 8.3%	+ 8.2%	+ 7.4%

* Excludes construction grades.

Source: Bureau of Labor Statistics

PROFITABILITY

Deterioration in paper industry pricing and red ink from wood products operations appear likely to result in a 35% to 45% drop in U.S. paper industry net earnings for 1982. This would be worse than the 21% decline experienced in the more severe 1974-75 recession and is on par with the 1970-71 recession year when net profits after taxes dropped 56% over a two-year period. Forest products producers (deriving more than half their sales from wood products but with significant paper operations) appear likely to register a 45% to 55% decline in profits for all of 1982.

Paper industry profits began to deteriorate in the fourth quarter of 1981 as demand weakened and price discounting started spreading through a number of key grades such as linerboard, uncoated white papers and market pulp. Paper company profits declined 13% for the fourth quarter, bringing the full year 1981 decline to 8% on a 6% rise in sales, according to a PULP & PAPER WEEK survey of 24 companies. Forest products producers net income dropped 28% for all of 1981, which followed a 31.5% decline in 1980 from 1979, when the three-year decline in housing—described as the worst since World War II—began its descent.

First-quarter 1982 profits of 23 paper companies dropped 40.3% from a year earlier as industry demand and pricing continued to deteriorate. Forest products industry net income declined 59.3%, with wood products operations of most major companies running at a deficit. The next PULP & PAPER WEEK survey showed earnings of 27 paper companies in the second quarter of 1982 were down 41%, while eight forest products firm's profits were 54% below year-earlier levels. A number of major paper and forest products companies reported losses for the second quarter of 1982, including Boise Cascade, Louisiana-Pacific, Mead, Southwest Forest Industries and Willamette Industries.

The earnings outlook for the third quarter of 1982 remained dismal, with little improvement in industry demand or pricing, but the period probably represented the trough of the recession. Most analysts expect paper and forest products earnings in the first quarter of 1983 to be higher than year-earlier levels, with paper industry earnings showing a substantial increase for the year and deeply depressed forest products net income making dramatic gains. Nevertheless, it could take paper company profits two or three years to return to 1979 record levels, while some analysts believe forest products companies will not achieve their previous earnings peak during the next upcycle.

Historical performance. The paper industry's financial performance improved during the 1970s, although inflation probably played a major role. After lagging the average for all manufacturing for two decades, paper industry return on net worth exceeded the average in the 1974-75 tight-market period. Paper industry return on net worth reached a peak of 16.8% in 1974 then declined to 12% to 13% range before hitting 16.0% in the 1979, according to Federal Trade Commission data. Since then paper industry return on net worth has been on the decline, averaging between 11% and 12% in 1980-81 and dropping to 6.2% in the first quarter of 1982.

Return on total capital (net worth plus long-term debt) has improved less dramatically, reflecting heavier debt loads built up by the industry. Long-term debt as a percentage of net worth rose from the low 20% range in the first half of the 1960s to an average of 47% in the 1970s and may have climbed higher in 1982. As profits dropped sharply in 1981-82, many companies did not react quickly enough in cutting back their capital spending programs and had to add to their short-term floating rate-debt burden at a time when they should have been reducing it. Operating income of some highly leveraged major forest products companies is inadequate to cover interest expense, and the deterioration of this and other financial ratios has caused a reduction in credit ratings for an number of major producers. Analysts expect a high priority of the industry in 1983 will be on improving financial liquidity and reducing debt levels.

U.S. PAPER & ALLIED PRODUCTS INDUSTRY FINANCIAL PERFORMANCE, 1960-81

(Dollar figures are millions)

					Financial ratios			
	Net sales	**% change from prior yr**	**Net profit after taxes**	**% change from prior yr**	**Profit margins**	**Return on net worth**	**Return on total capital**	**Debt to net worth**
1981*	$62,500	+14.2%	$3,100	+11.5%	5.0%	12.1%	—	—
1980*	54,737	− 1.1	2,781	−25.3	5.1	11.6	8.1	43.4
1979	55,359	+13.0	3,723	+43.3	6.7	16.0	10.9	47.5
1978*	48,982	+ 7.1	2,598	+ 9.8	5.3	12.5	8.5	47.6
1977*	45,750	+16.5	2,367	+ 4.3	5.2	12.0	8.2	47.0
1976	39,270	+22.6	2,270	+26.0	5.8	13.2	9.1	44.3
1975	32,044	− 2.4	1,801	−21.3	5.6	12.1	8.2	48.3
1974*	32,837	+23.9	2,287	+58.7	7.0	16.8	11.1	47.4
1973	26,503	+13.6	1,441	+53.1	5.4	12.5	8.7	44.0
1972	23,324	+ 4.9	941	+83.8	4.0	8.9	6.0	46.8
1971	22,224	+ 5.5	512	−28.8	2.3	4.8	3.2	49.2
1970	21,069	+ 2.2	719	−27.2	3.4	7.0	4.8	46.8
Average 1970-81		**+10.7%**		**+20.2%**	**5.1%**	**11.6%**	**7.9%**	**46.9%**
1969	20,607	+10.0	987	+11.0	4.8	9.7	6.8	41.8
1968	18,738	+10.9	889	+11.7	4.7	9.6	6.6	45.1
1967*	16,900	− 0.7	796	−12.6	4.7	8.8	6.2	41.5
1966	17,016	+11.8	911	+21.0	5.4	10.5	7.7	35.6
1965*	15,217	+ 3.0	753	+ 0.1	4.9	9.2	7.1	30.0
1964	14,771	+ 5.1	754	+18.9	5.1	9.1	7.3	23.7
1963	14,050	+ 2.6	634	+ 0.9	4.5	8.0	6.4	24.9
1962	13,698	+ 9.4	628	+ 7.7	4.6	8.1	6.5	25.1
1961	12,525	+ 6.5	583	− 0.7	4.7	7.6	6.2	22.6
1960	11,764	− 0.5	587	− 5.2	5.0	8.4	6.8	23.3
Average 1960-69		**+ 5.8%**		**+ 5.3%**	**4.8%**	**8.9%**	**6.8%**	**31.4%**

* Revised--change in corporations included in series so prior year data not exactly comparable.

Definitions: Profit margins = after-tax net profit to net sales. Return on net worth = after tax net profit to net worth. Return on total capital = after-tax profit to net worth + long-term debt. Debt to net worth = long-term debt to net worth.

Source: Based on Federal Trade Commission quarterly data compiled by American Paper Institute

U.S. PAPER AND FOREST PRODUCT COMPANY SALES AND EARNINGS FOR 1981

(000 dollars)

Paper companies	**Sales**	**% change 1981/80**	**Earnings[1]**	**% change 1981/80**
Chesapeake	$ 282,569	9.6	$ 26,230	11.9
Consolidated	536,899	5.2	54,663	4.0
Crown Zellerbach	3,148,300	2.7	75,300	−22.7
Diamond	1,341,000	4.6	31,800	−21.7
Federal Paper	520,347	9.3	31,044	6.6
Fort Howard	471,261	18.6	83,050	20.9
P.H. Glatfelter	265,540	1.0	16,502	−23.0
GN Nekoosa	1,493,000	8.7	95,000	−3.7
Hammermill	1,399,694	13.9	46,638	14.2
Intl. Paper	4,983,400	−1.2	265,500	−12.5
Kimberly-Clark	2,885,700	11.0	204,700	12.6
Longview (10/31)	389,450	8.8	11,261	750.5
Mead	2,899,722	7.1	106,874	−16.9
Mosinee	90,876	17.8	6,914	45.0
Pentair	223,982	6.2	8,153	−33.7
St. Regis	2,880,183	3.5	179,218	1.0
Scott	2,309,044	10.9[2]	133,340	32.1[2]
Sonoco	533,349	8.8	38,491	18.4
SW Forest	779,461	5.6	16,102	−50.1
Union Camp	1,665,888	5.8	168,948	2.3
Westvaco	1,550,529	10.9	100,791	16.0
Willamette	975,640	3.8	28,604	−51.4
Total	**31,626,234**	**5.9**	**1,622,249**	**− 7.8**
Forest products				
Boise Cascade	2,107,360	2.9	120,080	−11.3
Champion Intl.	4,004.027	6.7	119,646	−34.4
Georgia-Pacific	5,414,000	7.9[2]	160,000	−34.2[2]
Louis.-Pacific	1,023,050	−14.4	26,280	−56.2
Pope & Talbot	236,117	10.7	2,711	−75.6
Potlatch	880,493	7.6	57,804	18.6
Weyerhaeuser	4,501,512	−0.8	234,444	−27.1
Total	**19,166,559**	**3.3**	**720,965**	**−28.1**
U.S. total	**50,792,793**	**4.9**	**2,343,214**	**−15.1**

1. Income after taxes from continuing operations, excluding most significant nonrecurring items in both years.
2. 1980 figures restated by company.

U.S. PAPER & ALLIED PRODUCTS INDUSTRY PROFITABILITY vs ALL MANUFACTURING

	Net income change from prior year		After-tax profit margins		Return on net worth	
	Paper	**All mfg**	**Paper**	**All mfg**	**Paper**	**All mfg**
1980	−12%	+ 1%	5.6%	4.9%	13.6%	16.6%
1979	+33	+27	6.9	5.6	17.4	18.4
1978	+ 8	+17	5.7	5.2	14.0	15.9
1977	+ 9	+11	5.9	5.1	14.2	15.0
1976	+25	+29	6.0	5.1	14.7	15.0
1975	−22	−11	5.6	4.4	12.7	12.6
1974	+37	+13	6.8	5.2	18.3	15.2
1973	+67	+13	6.2	5.7	14.2	14.9
1972	+56	+31	4.3	5.1	8.8	12.1
1971	−23	−12	3.9	4.5	7.4	10.1
1970	−23	−12	3.9	4.5	7.4	10.1

Source: Citibank

CAPITAL SPENDING

Deteriorating profits, high interest rates, and underutilized existing capacity caused U.S. paper companies to sharply rein in their capital spending for 1982. A Commerce Dept. survey conducted in March and April found U.S. paper firms were planning to reduce outlays for new plant and equipment by 12.1% to $5.91 billion in 1982 from $6.72 billion in 1981. This would follow a 1.2% drop the previous year from 1980's peak of $6.80 billion.

Adjusted for an estimated 4.8% rate of inflation, "real" spending by the paper industry would be down about 17% vs a 3.5% decline for all manufacturing and a 2.4% drop for U.S. business as a whole. With only a moderate improvement in capacity utilization rates expected next year, capital spending may be down or flat in 1983, especially with the need of many major forest products companies to improve financial liquidity and reduce debt levels.

A more upbeat projection of U.S. paper industry spending was provided by McGraw-Hill's annual spring survey, which showed outlays declining only 1.8% to $6.60 billion in 1982, then rising by 11.2% to $7.34 billion in 1983 and then again to $9.24 billion in 1984. This survey, however, probably does not reflect more recent spending cutbacks, and the magnitude of the decline reported by the Commerce survey is supported by a Pulp & Paper Week review of 22 individual company spending plans (see table).

Forest products cutbacks. The most serious erosion in 1982 capital spending has taken place in the forest products sector of the industry where losses from wood products have seriously squeezed cash flow and limited ability to undertake any major capital commitments. Georgia-Pacific Corp. and Potlatch Corp., for example, slashed planned outlays for 1982 by around 70%, while Weyerhaeuser reduced spending by 32% compared with 1981 levels. "After our experience with recession-affected markets during the first four months of 1982, we have further cut back our spending plans to assure we maintain adequate financial strength and flexibility during these tough times," commented Richard B. Madden, Potlatch chairman and CEO.

Among pulp and paper companies with less involvement in the deeply depressed solid-wood side of the industry, the cutback in capital spending has been less drastic. International Paper Co., flush with funds from the sale of its Canadian operations, plans no significant cutbacks in its $4-billion spending program between

1982 CAPITAL SPENDING PLANS OF MAJOR U.S. PAPER COMPANIES AT MIDYEAR

(millions of $)

	1982	1981	1980	% change 1982/81
Boise Cascade	$237	$237	$432	—
Champion	250	235	257	6.4
Chesapeake	35	64	26	− 45.0
Crown Zellerbach	300	346	282	− 13.3
Federal	70	114	70	− 38.6
Fort Howard	40	46	85	− 13.0
Georgia-Pacific	200	675	585	− 70.4
GN Nekoosa	275	98	106	180.6
Hammermill Paper	150	141	100	6.4
International Paper	735	716	883	2.7
Kimberly-Clark	375	239	255	56.9
Mead	305	503	448	− 39.4
Packaging Corp.	46	34	45	35.3
Pentair	22	24	22	− 8.3
Potlatch	65	218	149	− 70.2
St. Regis Paper	330	438	337	− 24.7
Scott Paper	400	321	252	24.6
Southwest Forest	32	71	32	− 54.9
Stone	35	68	39	− 48.5
Union Camp	230	221	239	4.1
Westvaco	180	148	144	21.6
Weyerhaeuser	525	768	768	− 31.6

Source: P&P WEEK

1981-85 and is proceeding with a major modernization of its Georgetown, S.C., mill. Great Northern Nekoosa is planning to nearly triple spending with construction starting on a new joint-venture market pulp mill at New Augusta, Miss. Union Camp is holding spending at about last year's level, with construction beginning on its new Eastover, S.C., white paper mill. Kimberly-Clark Corp. and Scott Paper Co., are also planning fairly substantial spending boosts.

Disinflation. Where once companies boasted of huge billion-dollar, multi-year spending plans and large new installations, many executives in 1982 seemed more interested in talking about efforts to cut spending to the bone, conserve cash and concentrate on projects to

U.S. PAPER INDUSTRY CAPITAL SPENDING ESTIMATES FOR 1982

(billions of $)

	1982e	1981	1980	% change 1982/81
Commerce Dept.*				
Paper & allied	$ 5.91	$ 6.72	$ 6.80	−12.1%
All manufacturing	127.29	126.79	115.81	+ 0.4
McGraw-Hill*				
Paper & pulp	6.60	6.72	6.80	− 1.8
All manufacturing	131.20	126.79	115.81	+ 3.5

* Based on surveys conducted March/April 1982

U.S. PAPER AND ALLIED PRODUCTS COMPANIES CAPITAL SPENDING RELATED TO PROFITABILITY AND CAPACITY UTILIZATION

(millions of $)

	Capital spending	% change	Net profit after taxes	% change	Operating[3] rate
1982e	5910	−12.1%	2015	−35.0%	82.6%
1981	6720	− 1.2	3100	+43.3	89.2
1980	6800	+22.5	2781	+ 9.8	90.1
1979	5550	+39.1	3723	+43.3	93.6
1978	3990	+10.8	2598	+ 9.8	92.1
1977	3600	+15.8	2367	+ 4.3	89.9
1976	3110	+ 4.4	2270	+26.0	89.0
1975	2980	+ 3.1	1801	−21.3	79.2
1974	2890	+45.2	2287	+58.7	92.7
1973	1990	+36.3	1441	+53.1	96.3
1972	1460	+13.2	941	+83.8	95.8
1971	1290	−25.9	512	−28.8	91.5
1970	1740	+ 6.9	719	−27.2	90.4
1969	1620	+32.8	987	+11.0	92.8
1968	1220	+18.1	889	+11.7	91.4
1967	1490	+12.9	796	−12.6	88.3
1966	1320	+29.4	911	+21.0	93.0
1965	1020	+12.1	753	+ 0.1	92.5

Source: 1. Bureau of Economic Analysis; 2. Federal Trade Commission; 3. API improve efficiency and reduce raw material and labor costs. Many large new mill projects that looked attractive based on the continued future sharp escalation in pulp and paper prices may look somewhat questionable in the current disinflationary environment, some analysts say.

And the recent deceleration in fuel oil costs has made some energy projects involving shifts to alternative fuels begin to seem less urgent, with a number of major boiler projects becoming casualties of the spending cutbacks. Boise Cascade Corp., for example, postponed a $220-million coal-fired boiler project for its Rumford, Maine, mill, while Scott Paper delayed two wood-fired boilers that were part of a $400-million modernization of its Mobile, Ala., mill, and St. Regis deferred a wood/coal boiler at Bucksport, Maine, and a recovery boiler at its Lufkin, Texas, mill.

Historical trends. U.S. paper industry capital spending dropped by 26% in the 1971 recession, but has risen every year since then, even through the severe 1974-75 downturn when companies were making heavy outlays to achieve compliance with environmental regulations. In the 1972-75 period, between 30% to 38% of total primary industry capital spending went for air/water and solid waste control, according to National Council of the Paper Industry for Air & Stream Improvement. More recently energy programs to reduce dependence on fossil fuels and improve efficiency have claimed a substantial percentage of U.S. paper industry capital spending. A Pulp & Paper Project Report roundup in late 1981 counted 35 new power boilers and 19 new recovery boilers either under construction or being considered for installation at U.S. mills for a total cost of around $1.6 billion.

Another factor for the 14%/year rise in industry capital spending during the 1970s decade has been a rapid inflation in construction and capital goods costs. The following comparisons, though inexact, show how the costs of building new greenfield mills in several key grades have escalated. In 1971, Weyerhaeuser built a new 1600-tpd containerboard mill at Valliant, Okla., for a cost of about $100 million—or about $62,500/daily ton; while International Paper's new 2070-tpd Mansfield, La., mill which started up last year, cost $600 million—about $290,000/daily ton.

Weyco completed a 600-tpd kraft market pulp mill at New Bern, N.C., in 1970 for $50 million—or about $83,000/daily ton; while Great Northern Nekoosa's $540-million, 1000-tpd joint venture mill for startup in 1984 will have an average cost of $540,000/daily ton. Champion International built a $100-million, 500-tpd bleached kraft pulp and paper mill at Courtland, Ala., in 1971 for $200,000/daily ton; while the cost of Union Camp's new $600-million, 600-tpd Eastover, S.C., bleached kraft pulp and paper mill will average $1 million/daily ton when on-stream in 1984.

By categories. According to Pulp & Paper's annual capital spending survey conducted in late 1981, U.S. paper companies were planning to spend a total of $10.3 billion, most of which was to fall in the 1981-83 period. Of this total, pulping and fiber projects accounted for 28% of spending; new paper and board machines, 12%; modifications to existing machines, 6%; energy/power projects, 17.3%; miscellaneous plant expenditures, 24%; and environmental, 13%.

Primary pulp and paper manufacturing is considerably more capital-intensive than the converting segment of the industry, accounting for about 70% of total outlays by U.S. paper and allied products establishments, according to Bureau of Census data.

CAPITAL SPENDING BY U.S. PAPER AND ALLIED PRODUCTS ESTABLISHMENTS

(millions of $)

	Total (SIC 26)	Pulp mills	Paper mills	Paperboard mills	Converting plants Paper	containers & boxes	Building paper/board mills
1980	$5226	$259	$1,897	$1586	$799	$645	$40
1979	4447	240	1714	1229	725	491	48
1978	3736	195	1424	1000	604	496	19
1977	3295	301	1115	934	507	421	17
1976	3010	375	1044	844	394	335	12
1975	2718	294	832	807	412	347	26
1974	2214	136	723	637	315	342	63
1973	1530	119	508	344	304	227	26
1972	1335	136	372	314	289	206	19
1971	1197	135	374	228	262	180	18
1970	1397	122	503	239	289	227	18

Source: Bureau of the Census

CAPACITY EXPANSION

The pace of U.S. paper and board capacity growth is expected to slow after growing at a 2.6%/year pace over the 1980-82 period as the recession causes the postponement of some expansion projects and the permanent shutdown of certain older, less-efficient facilities. Low capacity utilization rates have made the addition of new capacity less urgent, and many major forest products companies need time to improve their financial liquidity before undertaking any major new capital commitments.

According to the last American Paper Institute capacity survey (released in late 1981), U.S. paper and board capacity was expected to grow at a 2.3%/year rate for the 1982-84 period, about in line with the 2.4%/year rate for the preceding 15 years. This would result in the addition of 5.01 million tons of paper and board capacity in this three-year period, bringing total capacity to 77.16 million tons in 1984.

Woodpulp capacity was expected to grow at a 1.9%/year pace over the 1982-84 period, below the 2.5%/year of the preceding 1967-81 period and trailing the growth rate of paper and board. The 3.29 million tons of woodpulp capacity expected to be added during the three-year period would bring total capacity by 1984 to 60.3 million tons.

SLOWER GROWTH AHEAD

Nevertheless, postponement of a number of major expansions and an undetermined number of incremental projects should result in a slowing of capacity growth in 1984 and 1985. Weyerhaeuser Co., for example, has indefinitely postponed a 200,000-tpy uncoated free-sheet machine and kraft pulp mill at Columbus, Miss., which was included in the last survey for 1984 startup. Beyond the scope of the last survey, a large number of projects have been announced as under consideration but have no definite startup dates and may well be delayed into the second half of the 1980s.

However, two major projects have been announced since the 1981 survey that are moving ahead: Great Northern Nekoosa Corp. and Kymi Kymmene of Finland are building a 300,000-tpy bleached kraft market pulp mill at New Augusta, Miss., for startup in 1984; and International Paper Co. is converting its Georgetown, S.C., mill to the production of 120,000 tpy of uncoated free-sheet and 300,000 tpy of bleached kraft market pulp by 1984. The conversion will eliminate 465,000 tpy of unbleached kraft linerboard capacity at the mill.

The conservative methodology used in compiling the API survey also tends to overstate current capacity levels. Capacity that has been indefinitely shut down is not eliminated from survey totals until at least a year has passed to insure that the equipment will not be reactivated. The 1981 API survey reported that a total of 84 machines and 31 complete mills were scheduled for shutdown over the 1980-82 period, of which 1.4 million tons had been eliminated, while another 609,000 tons was still included in the survey totals.

A survey of capacity closures reported in PULP & PAPER WEEK shows that a total of 1.2 million tpy of capacity has been shut down between the beginning of 1981 and August 1982. Among the larger of these shutdowns were IP's 214,000-tpy semichemical medium mill at Bastrop, La., Boise Southern's 106,000-tpy unbleached kraft paper mill at Elizabeth, La., Nitec Paper's 120,000-tpy coated paper/tissue mill at Niagara Falls, N.Y., three machines at Scott Paper's Chester, Pa., mill, Boise Cascade's 91,000-tpy Salem, Ore., uncoated free-sheet mill, four packaging paper/board machines at Manville Forest's West Monroe, La., mill and Clevepak's recycled paperboard mill at Piermont, N.Y. Bruce Kirk of Goldman Sachs estimates that by the end of 1982 between 1.2 and 2.0 million tons of capacity will have been shut down by the industry.

PAPER EXPANSION FASTEST

U.S. paper capacity was expected to rise at a 2.9%/year rate over the 1982-84 period, with newsprint and

U.S. PULP AND PAPER INDUSTRY AVERAGE ANNUAL CAPACITY GROWTH, 1982-84 AND PRIOR FIFTEEN YEARS

(000 short tons)

	Additions 1982-84		Additions 1967-81	
Grades	**3-year increase**	**Average annual growth**	**15-year increase**	**Average annual growth**
Paper and paperboard				
Total all grades	**5,014**	**2.3%**	**21,938**	**2.4%**
Total paper	**3,012**	**2.9**	**11,216**	**2.7**
Newsprint	608	3.7	2,732	5.0
Printing/writing	1,899	3.5	6,600	3.2
Packaging/indus. converting	244	1.3	204	0.2
Tissue	260	1.7	1,681	2.7
Total paperboard	**2,068**	**2.0**	**10,060**	**2.3**
Unbleached kraft	1,080	2.1	7,300	3.9
Solid bleached	22	0.2	986	1.9
Semichemical	614	4.0	1,866	3.2
Recycled	352	1.3	(93)	—
Construction grades	**(66)**	**(0.5)**	**662**	**1.1**
Woodpulp				
Total all grades	**3,293**	**1.9%**	**17,911**	**2.5%**
Dissolving & special alpha	—	—	109	0.5
Sulfite	48	0.8	(1,006)	(2.0)
Sulfate & soda	1,929	1.5	15,343	3.1
Semichemical	563	3.9	1,212	2.0
Mechanical	753	3.2	2,253	2.4

Source: American Paper Institute, "Paper/Paperboard, Woodpulp Capacity" (1981)

printing/writing grades showing the fastest growth, according to the 1981 API survey.

• **Newsprint.** During 1980-81, U.S. newsprint capacity grew by an extraordinary 1.1 million tons, or 26.2%, to reach 5.3 million tons. This increase, based on the installation of four new machines and incremental expansions, exceeded the total gain in U.S. newsprint capacity over the previous ten years. Over the 1982-84 period, only two major expansion projects are reported: a new 225,000-tpy machine Abitibi-Price Southern Corp. will start up in Augusta, Ga., in 1983 and Southwest Forest Industries' 1982 conversion of a linerboard machine to 120,000 tpy of newsprint at its Snowflake, Ariz., mill. The projected capacity growth from these and other smaller expansions totals 608,000 tons and represents a more modest 3.7%/year rate of increase for the 1982-84 period.

• **Printing/writing papers.** Magazine industry growth and a tight publication paper market has stimulated capacity growth in coated groundwood papers. In 1980-81, capacity expansions for this grade totaled 527,000 tons, a 20.6% increase. In the three years from 1982-84, further expansions of 669,000 tons are planned which will increase capacity by an additional 21.7%, with Mead, St. Regis and Weyerhaeuser all starting up new machines around mid-1982.

Uncoated free-sheet capacity, the largest printing/writing grade, was expected to reach 9.5 million tons in 1984, for a growth rate averaging 2.7%/year. Union Camp, Crown Zellerbach and Champion International all have new machines scheduled for startup in 1984. The postponement of Weyco's 200,000-tpy machine at Columbus, Miss., will be partially offset by IP's conversion of one Georgetown, S.C., machine to uncoated free-sheet in 1984.

• **Kraft paper.** Despite the startup of St. Regis Paper's new 236,000-tpy machine at Pensacola, Fla., and two other incremental expansions, kraft paper capacity in the last survey was expected to show only a 113,000-ton increase over the 1982-84 period, partly due to the conversion of another kraft paper machine to a different grade. Even this minor gain will be wiped out next year when Boise Southern's idled Elizabeth, La., mill is dropped from capacity totals.

• **Tissue.** Despite earlier concern about growing overcapacity in this grade, the last API survey showed tissue increasing at only a 1.7%/year rate over the 1982-84 period for a 260,000-ton increase—considerably below the 2.7% rate of the past 15 years. Only one 65,000-tpy tissue machine is planned for startup in the latest three-year period, and part of the 1982 capacity increase at Wisconsin Tissue's Menasha, Wis., mill will be offset by shutdown of an older machine. Still to be substracted from survey totals is about 156,000 tpy of older tissue capacity shut down in 1982 by Scott Paper and Nitec—although the latter may eventually be restarted. Beyond the last survey, Fort Howard is expected to move ahead with installation of a fourth tissue machine at its Muskogee, Okla., mill for startup in 1985.

SLOWER PAPERBOARD GROWTH

Paperboard capacity is expected to increase at only a

U.S. WOODPULP ANNUAL CAPACITY GROWTH, 1978-84

(000 short tons)

	1984e	1983e	1982e	1981	1980	1979	1978
TOTAL WOODPULP	60,303	59,603	58,470	57,010	55,214	53,636	52,714
Dissolving	1,590	1,590	1,590	1,590	1,590	1,551	1,573
Chemical paper grades	45,148	44,733	44,092	43,172	41,893	40,897	39,997
Sulfite paper grades	1,946	1,911	1,905	1,898	1,909	2,004	2,095
Sulfate & soda paper grades	43,202	42,822	42,187	41,274	39,983	38,893	37,903
Bl & semibl softwood	12,194	12,031	11,843	11,649	11,339	10,897	10,442
Bl & semibl hardwood	9,001	8,839	8,683	8,530	8,356	8,072	7,729
Unbleached	22,007	21,953	21,662	21,095	20,288	19,923	19,732
Semichemical	5,228	5,160	4,826	4,665	4,601	4,553	4,572
Mechanical	8,266	8,049	7,890	7,513	7,069	6,572	6,507
For paper and paperboard	6,246	6,029	5,870	5,482	5,070	4,573	4,580
For other paper and board	2,020	2,020	2,020	2,031	1,999	1,999	1,926
Screenings	71	71	71	70	61	63	65
TOTAL MARKET PULP	7,089	7,110	7,022	6,987	6,801	6,334	5,746

Source: American Paper Institute, "Paper/Paperboard, Woodpulp Capacity" (1981)

2.1%/year annual rate during the 1982-84 period, according to the last capacity survey—and even this should prove high, with subsequent announcements that at least eight paperboard machines would be indefinitely shut down.

- **Unbleached kraft paperboard.** Kraft paperboard capacity from 1982-84 is expected to increase by 1.08 million tons, averaging 2.1%/year. With accelerated startup of Stone Container's new machine at Florence, S.C., only one new machine is scheduled to start up during this three-year period—Weyco's 200,000-tpy machine at Valliant, Okla., which came on-stream in mid-1982. This lack of expansion reflects the low profitability of linerboard relative to other grades and decisions by several financially squeezed forest products firms to postpone proposed machines beyond 1984.

IP's Georgetown mill conversion to bleached grades announced since the the last API capacity survey has resulted in one 185,000-tpy liner machine being shut down at the end of 1981 and another 280,000-tpy machine scheduled for conversion in 1984. Elimination of these machines would indicate a linerboard growth rate of only 1.2% for the 1982-84 period. The growth rate for all unbleached kraft board would be further reduced by the permanent shutdown of two clay-coated kraft carrier board machines with a combined capacity of 147,000 tpy at Manville Forest Products.

- **Semichemical medium.** Semichemical medium will show the strongest growth of any paperboard grade, rising by 614,000 tons or at a 4.0%/year rate during the 1982-84 period, with a machine that started up in late 1981 at IP's new Mansfield, La., mill and another scheduled to begin operation at MacMillan Bloedel's Pinehill, La., mill in 1983. Partly offsetting the 614,000-ton increase shown in the last capacity survey, however, has been IP's indefinite shutdown of its 214,000-tpy Bastrop, La., mill and Manville Forest Products' closure of a 106,000-tpy machine at West Monroe, La.
- **Solid bleached paperboard.** Capacity is expected to show only slight growth through 1984, with IP announcing since the last survey that an additional 100,000 tpy of capacity will be available at its Texarkana, Texas, mill in 1984.
- **Recycled paperboard.** No other industry segment has retired as much capacity as the producers of recycled paperboard. Since 1970, 87 recycled paperboard machines, with a total capacity of 2.75 million tons, or 34% of the industry's entire tonnage, have been shut down. Of this total, 2.3 million tons represent permanent shutdown of dismantled facilities which have been removed from the API capacity totals.

Despite these capacity reductions, rebuilds of existing machines have succeeded in offsetting the losses, and capacity for recycled paperboard has remained flat for many years. Some modest growth in capacity, a total of 352,000 tons, is planned for the 1982-84 period—a gain which could be offset by 415,000 tons of idle capacity that still hadn't been removed from the last API survey. However, some of this capacity may come back to life, with a new company planning to start up an idle 120,000-tpy mill at Durham, Pa., in mid-1982 and Container Corp. of America taking an option to acquire a 330,000-tpy mill at Whippany, N.J. Both of these mills have been idle since 1980 when Whippany Paper Board Co. went into Chapter 11 under the federal bankruptcy code.

WOODPULP EXPANSION PICKS UP

Capacity for total sulfate and soda pulps will grow at a rate averaging 1.5%/year to reach a total of 42.2 million tons in 1984, according to the last capacity survey. This rate of expansion trails the long-term growth rate for these pulps, which has averaged over 3%/year, and also trails the growth rate of paper and paperboard. The reason for these disparate growth rates is that several paper and paperboard expansions will consume significant quantities of wastepaper, while others will utilize existing woodpulp facilities, according to API.

This diversion of market pulp into new paper and paperboard expansions helps account for a virtual flat trend in market pulp capacity shown in the last API survey for the 1982-84 period. This is in strong contrast to the 5.2%/year growth shown for market pulp, about 73% of which consists of sulfate pulp. Since the last survey, however, announcement of Great Northern's new 315,000-tpy bleached kraft market pulp mill for Mississippi and IP's addition of 300,000 tpy of market pulp at Georgetown should cause growth rates to return to a better than 2.5% rate.

Total sulfite woodpulp capacity has dropped from 2.4 million tons in 1970 to 1.9 million tons in 1981 and is expected to remain fairly stable through 1984, according to the last capacity survey. Of the 22 remaining sulfite mills in operation, 15 have capacities less than 50,000 tpy and already in 1982 two older facilties have been shut down.

Thermomechanical pulp is continuing to show rapid growth, with capacity rising from 1.8 million tons in 1982 to 2.2 million tons in 1984 for an average annual growth of 10.7%.

REGIONAL GROWTH TRENDS

The South Atlantic and South Central states will continue to dominate capacity growth in paperboard and woodpulp. These states will provide 2.17 million tons of additional containerboard capacity and 3.82 million tons of new woodpulp capacity in 1981-84, according to the last API survey. These regional expansions will comprise 89.9% and 75.1% respectively of all growth in capacity for these grades. New England and east-northcentral states will account for most of the gains in printing/writing capacity, and the Mountain and Pacific states will provide most of the new newsprint capacity.

NEW MILLS AND MACHINES ANNOUNCED FOR THE U.S.

Company	Location	Project	Grade	Capacity (short tpy)
For 1981				
Boise Cascade	Rumford, Maine	new machine	coated groundwood	160,000
Buckeye Cellulose	Oglethorpe, Ga.	new mill	bleached kraft pulp	300,000
Fort Howard Paper	Muskogee, Okla.	new machine	tissue	85,000
Georgia-Pacific	Palatka, Fla.	new machine	tissue	60,000
International Paper	Mansfield, La.	new mill with	kraft linerboard	460,000
	Mansfield, La.	two machines	semichemical medium	270,000
Madison Paper[1]	Madison, Maine	new machine	uncoated groundwood	160,000
Mead	Chillicothe, Ohio	new machine	uncoated free sheet	154,000*
North Pacific Paper[2]	Longview, Wash.	new machine	newsprint	210,000
Scott Paper	Everett, Wash.	new machine	tissue	54,000
Stone Container	Florence, S.C.	new machine	kraft linerboard	105,000
Willamette Industries	Hawesville, Ky.	new machine	uncoated free sheet	100,000
St. Regis Paper	Pensacola, Fla.	new machine	unbleached kraft paper	236,000*
For 1982				
Mead	Escanaba, Mich	new machine	coated groundwood	200,000
St. Regis Paper	Sartell, Minn	new machine	coated groundwood	170,000
Weyerhaeuser	Columbus, Miss.	new mill	coated groundwood	175,000
Weyerhaeuser	Valliant, Okla.	new machine	kraft linerboard	200,000
Wisconsin Tissue	Menasha, Wis.	new machine	tissue	65,000
For 1983				
Abitibi-Price Southern[3]	Augusta, Ga.	new machine	newsprint	225,000
MacMillan Bloedel	Pine Hill, Ala.	new machine	semichemical medium	210,000
Scott Paper	Skowhegan, Maine	new machine	coated free sheet	200,000
For 1984				
Champion	Courtland, Ala.	new machine	uncoated free sheet	150,000
Crown Zellerbach	Camas, Wash.	new machine	uncoated free sheet	160,000
Union Camp	Eastover, S.C.	new mill	uncoated free sheet	215,000
Leaf River Inc.[4]	Hattiesburg, Miss.	new mill	bleached kraft pulp	315,000
Proposed projects (1985 and beyond)				
Fort Howard Paper	Muskogee, Okla.	new machine	tissue	n.a.
Weyerhaeuser	Columbus, Miss.	new machine	uncoated free sheet	200,000
Champion	Quinnesec, Mich.	new mill	bleached kraft pulp	265,000
Georgia-Pacific	Port Hudson, La.	new machine	uncoated free sheet	140,000
Georgia-Pacific	Palatka, Fla.	new machine	kraft linerboard	300,000
Georgia Kraft	Elberton, Ga.	new mill	kraft linerbaord	455,000
Owens-Illinois	Valdosta, Ga.	new machine	kraft linerboard	n.a.
Inland Container	Rancho Cucamonga, Calif.	new mill	recycled paperboard	n.a.
Sunbelt Forest[5]	Boligee, La.	new mill	newsprint	210,000
Boise Cascade	Internatl. Falls, Minn.	new machine	uncoated free sheet	n.a.
Bowater	Catawba, S.C.	pulp expansion	bleached kraft pulp	270,000
Blandin Paper	Grand Rapids, Mich.	new machine	coated groundwood	n.a.
Westvaco	Wickliffe, Ky. or Luke, Md.	new machine	coated free sheet	150,000
Longview Fibre	Longview, Wash.	new machine	unbleached kraft paper	n.a.

Continued next page

NEW MILLS AND MACHINES ANNOUNCED FOR THE U.S., continued

Company	Location	Project	Grade	Capacity
Independent Kraft[6]	Tuscaloosa, Ala.	new mill	kraft linerboard	280,000
Augusta Kraft[7]	Augusta, Ga.	new mill	kraft linerboard	262,500
Publishers Paper	Oregon City, Ore.	new machine	newsprint	n.a.*
North Miss. Paper[8]	Batesville, Miss.	new mill	newsprint	200,000
Champion	Halifax, N.C.	new mill	uncoated free sheet	n.a.
Champion	Kirbyville, Texas	new mill	kraft linerboard	350,000
Weyerhaeuser	Columbus, Miss.	new machine	coated groundwood	n.a.
Boise Cascade	South Carolina	new mill	pulp/newsprint	n.a.
Kimberly-Clark	Southeast	new mill	bleached kraft pulp	n.a.

* New capacity will replace at least some existing facilities so net increase in production will be smaller.

1. Partnership of Myllykoski Oy of Finland and New York Times Co.
2. Owned 90% by Weyerhaeuser and 10% by Jujo Paper Co. of Japan.
3. Joint venture of Abitibi-Price and Thomson Newspapers Ltd. of England.
4. Owned 95% by Great Northern Nekoosa and 5% by Kymi Kymmene Oy of Finland.
5. U.S. subsidiary (formerly known as ISA International) of Haindl Papier of West Germany
6. Organized by Robert Blume with financial backing from the Sherower Group of the Netherlands.
7. Backing unknown, but believed to include independent box plants and possible European interests.
8. Southern newspaper publishers and woodlot owners.

n.a. = not available

U.S. PAPER AND PAPERBOARD MILLS AND MACHINES SHUT DOWN BETWEEN 1980-82 AND 1976-79

	1980-82		Annual capacity (000 tpy)		1976-79		
Grades	No. of machines	No. of complete mills	Removed from survey totals	Not removed from survey totals*	No. of machines	No. of complete mills	Annual capacity (000 tpy)
Total	84	31	1,441	609	107	28	2,629
Paper							
Newsprint	—	—	—	—	3	1	231
Printing/writing	16	2	186	6	28	3	476
Packaging/ind. conv.	8	2	97	108	24	4	357
Tissue	18	7	138	45	16	5	54
Paperboard							
Unbleached kraft	4	—	262	—	1	1	240
Bleached kraft	—	—	—	—	2	1	162
Semichemical	3	1	128	—	2	6	145
Recycled	18	8	332	415	20	6	645
Construction grades	17	11	298	35	11	7	219

* Machines or mills indefinitely shut down are not removed from capacity totals for one year since they could be reactivated.

Source: American Paper Institute

U.S. PAPER & BOARD ANNUAL CAPACITY GROWTH, 1978-84

(000 short tons)

	1984e	1983e	1982e	1981	1980	1979	1978
TOTAL, ALL GRADES PAPER & BOARD	77,162	76,031	74,558	72,418	70,716	69,003	67,419
TOTAL PAPER	36,651	35,746	34,927	33,639	32,659	31,179	30,460
Newsprint	5,907	5,710	5,583	5,229	4,836	4,199	4,104
Printing, writing & related	19,230	18,556	18,011	17,331	16,798	16,057	15,566
Uncoated groundwood	1,781	1,779	1,744	1,658	1,624	1,541	1,435
Coated groundwood	3,750	3,652	3,364	3,081	2,762	2,554	2,450
Coated free sheet	2,492	2,359	2,254	2,226	2,222	2,268	2,096
Uncoated free sheet	9,532	9,123	9,017	8,791	8,645	8,152	7,847
Cotton fiber	144	143	142	143	139	134	131
Thin papers	373	372	372	373	382	393	395
Solid bleached bristols	1,155	1,127	1,088	1,060	1,024	1,016	1,194
Packaging & industrial converting	6,191	6,183	6,140	5,947	6,072	6,053	6,146
Unbleached kraft	4,223	4,196	4,167	3,991	4,110	4,098	4,223
Bleached packaging & industrial converting	545	540	539	558	597	1,105[1]	1,041[1]
Special packaging	531	540	539	533	498	—[1]	—[1]
Special industrial	892	888	805	865	866	850	883
Tissue	5,322	5,297	5,193	5,062	4,954	4,870	4,644
TOTAL PAPERBOARD	36,313	36,087	35,428	34,245	33,709	33,436	32,631
Unbleached kraft	17,765	17,661	17,422	16,685	15,967	15,546	15,054
of which kraft linerbd	16,396	16,307	16,086	15,340	14,586	14,199	13,864
Solid bleached	4,037	4,048	4,094	4,015	4,180	4,268	4,197
Semichemical	5,556	5,447	5,180	4,952	4,946	4,864	4,739
Recycled	8,945	8,901	8,776	8,593	8,617	8,757	8,642
CONSTRUCTION PAPER/ BOARD & OTHER	4,198	4,198	4,203	4,264	4,347	4,419	4,327

1. Specialty packaging (mostly for food) combined with bleached packaging and industrial converting.

* Capacity additions for 1980 include only presently known commitments and do not necessarily represent final expansion plans of the industry for that year.

Source: American Paper Institute, "Paper/Paperboard, Woodpulp Capacity" (1981)

REGIONAL DISTRIBUTION OF PAPER/BOARD AND TOTAL WOODPULP ANNUAL CAPACITY

(000 short tons)

	1984e	1980	1976
TOTAL PAPER/BOARD*			
New England	6,251	5,712	5,189
Mid-Atlantic	6,494	6,452	6,570
East North Central	12,045	11,253	11,235
West North Central	2,007	1,856	1,868
South Atlantic	18,329	16,945	15,693
East South Central	9,595	8,515	8,793
West South Central	11,591	10,267	9,591
Mountain & Pacific	10,850	9,716	9,643
Total U.S.	77,162	70,716	68,583
TOTAL WOODPULP*			
New England	3,451	3,253	3,213
Mid-Atlantic	1,498	1 1,465	1,645
East North Central	3,767	3,532	3,582
West North Central	979	899	1,112
South Atlantic	18,798	17,364	16,336
East South Central	10,246	9,251	8,910
West South Central	11,464	10,059	9,251
Mountain & Pacific	10,099	9,391	9,829
Total U.S.	60,303	55.214	53,880

Regions are as follows:
New England: Me., N.H., Vt., Mass., Ct., R.I.,
Mid-Atlantic: N.Y., Pa., N.J.,
East North Central: Wis., Mich., Ill., Ind., Ohio;
West North Central: N. Dak., S. Dak., Minn., Neb., Iowa, Kan., Mo.;
South Atlantic: Del., Md., W.V., Va., N.C., S.C., Ga., Fla.;
East South Central: Ken., Tenn., Miss., Ala.;
West South Central: Okla., Ark., Texas, La.;
Mountain/Pacific: Wash., Ore., Ca., Nev., Ida., Mt., Wyo., Utah, Az., N.M.

* Includes construction paper and board and pulp to produce these grades.

Source: American Paper Institute annual capacity survey

PAPER/PAPERBOARD MACHINES INDEFINITELY SHUT DOWN BETWEEN 1981 AND MID-1982

Company	Millsite	Shut[1]	000 tpy	Grade	Date
Allied Paper	Kalamazoo, Mich.	2 PMs	35	specialty paper	1/81
Manville Forest	West Monroe, La.	1 PM		unbl kraft paper	9/81
International Paper[2]	Bastrop, La.	mill (2)	214	semichemical medium	6/81 & 1/82
Boise Southern	Elizabeth, La.	mill (3)	106	unbl kraft paper	11/81
Nitec Paper[2]	Niagara Falls, N.Y.	mill (6)	80	coated paper	1/82
			40	tissue	4/82
James River	Bristol, Pa.	mill (3)	18	specialty paper	1/82
	Riegelsville, Pa.	mill	5	specialty paper	3/82
Scott Paper	Chester, Pa.	3 PMs	88	tissue	4/82
Crown Zellerbach	Moreau, N.Y.	mill	50	deinked pulp	4/82
Weyerhaeuser	Rothschild, Wis.	2 PMs	42	bl packaging paper	3/82
Boise Cascade	Salem, Ore.	mill (4)	91	unctd free-sheet	6/82
Scott Paper	Oconto Falls, Wis.	1 PM	26	tissue	6/82
Consolidated	Appleton, Wis.	mill	42	sulfite pulp	9/30
Manville Forest[2]	West Monroe, La.	1 PM	106	corrugating medium	6/82
		2 PMs	147	ctd kraft board	6/82
Clevepak	Piermont, N.Y.	mill (1)	60	recycled board	8/82
Total capacity shut down:		9 mills, 31PMs	1185	paper/paperboard	

[1] ( ) following word 'mill' indicate number of paper machines.

[2] Possibility that some or all of the capacity may eventually be reopened.

API Capacity Survey (1981) indicates 609,000 tpy of capacity that has been shut down but not removed from its survey totals becauase closures are less than a year old.

MERGERS AND ACQUISITIONS

Acquisition interest in U.S. paper industry assets has been waning due to high financing costs, poor profit performance of the forest products industry, and declining timber values—once seen as an inflation hedge. At the same time, more paper industry assets are being put up for sale as companies try to restructure operations, sell off less profitable units and strengthen balance sheets in a difficult economic climate. As a result, assets which might have been snapped up a few years ago are having difficulty finding buyers.

Several major diversified companies in the last few years have made decisions to redeploy their assets outside the paper and forest products industry. Gulf & Western Industries sold its controlling interest in Brown Co.'s pulp and paper operations and some timberland to James River Corp., with its two recycled tissue mills in Wisconsin going to Pope & Talbot Inc. American Can Co. sold its U.S. tissue and bleached board mills and some timberland to James River Corp., retaining only its pulp mill in Marathon, Ont. ITT in 1980 sold its two British Columbia pulp mills and related forest products operations to Western Forest Products Ltd., a consortium of three British Columbia companies, and then offered to sell its four U.S. dissolving and paper-grade pulp mills and 1.3 million acres of timberland in the South and Pacific Northwest for a reported $3 billion—but no buyers were found and the assets were withdrawn from the market.

Heavy financial demands are also causing some major paper and forest products companies to try to sell off older, less profitable facilities or to find partners to help modernize them. International Paper Co., for example, sold its Panama City, Fla., linerboard/market pulp mill to Southwest Forest Industries in 1979 and then in 1981 sold off all of its Canadian operations to Canadian Pacific Enterprises and is using the funds in a major program to modernize its southern mills. Crown Zellerbach Corp. is targeting its capital spending on its major mills in Camas, Wash., Wauna, Ore., Bogalusa, La., and St. Francisville, La., while other facilities may either be closed or sold if they do not meet profit objectives. The company has put its 90%-owned Canadian subsidiary up for sale and is looking for a Japanese partner to assist in the modernization of its Port Townsend, Wash., kraft paper/board mill. St. Regis Paper Co. is also looking for partners to provide financial assistance in modernizing its older kraft paper/board mill in Jacksonville, Fla.

Some companies have been able to expand rapidly by gobbling up paper industry assets that other companies have decided to divest. James River is the most dramatic example, rising through a series of acquisitions to become about the tenth largest U.S. paper company in sales in a little more than a decade since its founding in 1969. Purchase of American Can's U.S. paper industry assets in 1982 for $446 million more than doubled the size of James River to close to $2 billion in sales, further integrated the company into pulp production and made it a major national producer of tissue and folding cartons.

Foreign companies have also been among those purchasing U.S. paper industry assets in recent years. Jefferson Smurfit of Ireland in 1981 completed the purchase of Alton Packaging Corp. in 1981, expanding the company's toehold in the U.S. containerboard/packaging market. This was further expanded in 1982 through the purchase of Diamond International's paperboard, converting and printing operations. The remainder of Diamond is being acquired by Canvenham Holdings Ltd., which is controlled by British financier Sir James Goldsmith. Other moves by foreign companies to buy U.S. paper industry assets include the purchase of the Keyes Molded Pulp Group of Arcata by Royal Packaging Industries Van Leer of the Netherlands and the earlier acquisition of Appleton Papers division of NCR Corp. by B.A.T Industries of Britain.

Two Canadian companies have also recently acquired significant stakes in the U.S. paper industry. Brascan Ltd., the Toronto mining and financial services company, purchased a 20.5% stake in Scott Paper Co. for about $220 million but agreed not to expand its interest beyond 25% before 1986. British Columbia Forest Products, itself partially owned by Mead and Scott, acquired Blandin Paper Co. in 1977—an action that is still facing an antitrust challenge—as is B.A.T's acquisition of Appleton Papers.

MAJOR ACQUISITIONS INVOLVING U.S. PAPER INDUSTRY ASSETS

Acquiring company	Assets purchased	Estimated value (million $)	Year effective
Cavenham Holdings (affiliate of Sir James Goldsmith of Britain)	59.3% of Diamond International not already owned	500	pending
Container Corp. of America	Eden recycled containerboard mill of Whippany Paper Board	13	proposed
Jefferson Smurfit of Ireland	Diamond Intl. paperboard, converting and printing assets	80	1982
James River Corp.	American Can tissue/ bleached board mills in U.S.	446	1982
Brascan Ltd. (of Canada)	50.5% interest in Scott Paper	220	1981
Royal Packaging Industries Van Leer (Netherlands)	Keyes Molded Pulp Container Group of Arcata	not disclosed	1981
Weyerhaeuser	most of Menasha Corp.'s West Coast assets	66	1981
Jefferson Smurfit	purchase of the remaining 19.4% of Alton Packaging not owned	50*	1981
James River Corp.	most of Brown Co.'s pulp/paper operations, some timberland (Gulf + Western former controlling shareholder)	172	1981
Pope & Talbot	purchase of two Brown tissue mills in Wisconsin	32	1980

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MAJOR ACQUISITIONS, U.S. PAPER INDUSTRY, continued

Acquiring company	**Assets purchased**	**Estimated value (million $)**	**Year effective**
Southwest Forest Industries	Panama City mill of International Paper	220	1979
Johns-Manville	Olinkraft subsidiary of Olin Corp.	585	1979
Georgia-Pacific	Hudson Pulp & Paper	113	1979
P.H. Glatfelter	Bergstrom Paper	24	1979
International Paper	Bodcaw Co., including Pineville Kraft	805	1979
B.A.T. Industries (of Britain)	Appleton Papers, div. NCR	280	1978
Louisiana-Pacific	most Fibreboard Corp. assets	60	1978
Time Inc.	Inland Container	280	1978
Arcata National	Keyes Fibre	88	1978
Champion International	Hoerner Waldorf	340	1977
St. Regis Paper	Southland Paper Mills	245	1977
British Columbia Forest Products (Canada)	Blandin Paper	75	1977
Boise Cascade	Oxford Paper, div. of Ethyl Corp.	90	1976
Mobil	Container Corp. of America (remaining 46% of Marcor not owned)	884	1976

*Approximate purchase price for 100% of shares outstanding

EMPLOYMENT

Labor is a major cost factor in the pulp and paper industry, comprising as much as 30% of a mill's total costs, although payroll expense may be as low as 10% at large modern facilities.

Employment in the pulp and paper industry has recently been in decline due to layoffs caused by the recession and gradual industry modernization. Total employment in the paper and allied products industry as of mid-1982 stood at 665,000, of which 496,000 were production workers, according to Bureau of Labor Statistics data. This represented a drop of 32,000 in total employment from a year earlier. By industry segments, total employment in mid-1982 broke down as follows: paper and pulp mills 194,000; paper mills (except building paper) 168,000; paperboard mills 61,000; miscellaneous paper converting (coating, envelopes, bags, etc.) 215,000; and paperboard converting (containers and boxes) 190,000.

Wage rates. Wages rates in the U.S. pulp and paper industry have been rising at about a 9% annual rate year for the past few years. According to American Paper Institute, hourly pay for all employees in the pulp and paper industry in 1981 averaged $8.60 an hour, a 9.6% increase from the 1980 average hourly wage of $7.85. In April 1982, the average hourly pay reached $9.13, a 6.6% rise from 1981, while the output per employee hour decreased 1.3% during the same period (0.65% for production workers alone).

This decline in productivity was affected by the recession, but continues the pattern of the past decade in which wage rates substantially outpaced growth in output per employee hour, resulting in a sharp escalation in unit labor costs for the industry. After remaining fairly stable in the 1950s and 1960s, unit labor costs during the 1970s jumped about 60%, reflecting a 131% increase in hourly earnings, while output per hour worked went up only 44%.

Wage levels at primary mills are higher than in the converting segment of the industry. Average hourly earnings at pulp, paper and paperboard mills were approaching $11/hour in May 1982 while wages at paper and container converting plants were just above the $8/hour level.

On a regional basis, U.S. pulp and paper workers earn the highest wages in the Pacific Coast section of the country. Their representative average straight-time earnings stood at $11.66/hour in 1981, according to one industry analyst, while comparable wage rates in the South were $10.37; Northeast, $9.41; Midwest, $9.26. The U.S. Northwest region wage is still lagging behind the rate paid in British Columbia, considered to be the highest in the world.

Pulp and paper workers' wages have not risen as fast as the consumer price index, however. In 1981, the CPI rose 9.9%, while the average raise in pay in the U.S. industry increased just 8.6%—the first time since 1973 the increase has averaged less than 9%, according to API. On a regional basis, Pacific Coast and Northeast workers got a 9% wage boost; New England, 8.8%; Midwest, 8.5%; South 8.2%.

1982 bargaining. The rise in wage rates is expected to

TOTAL U.S. PAPER & ALLIED PRODUCTS INDUSTRY EMPLOYMENT BY SEGMENTS

(000)

	1982	1981	1980	1979
Paper and allied products	664.5[1]	687.8	692.8	706.8
Paper and pulp mills[3]	194.0[2]	203.2	203.3	205.9
Paperboard mills	60.6[2]	64.3	65.1	65.5
Misc. converted paper products	215.1[2]	219.7	219.6	221.4
Paperboard containers/boxes	190.2[2]	201.5	204.9	214.0

1. For June
2. For May
3. Include construction paper/board mills

Source: Bureau of Labor Statistics

abate somewhat in 1982 and probably 1983 due to growing layoffs, depressed paper industry profits, lower settlements in other key industries, and a slowing general rate of inflation. This was already apparent in mid-1982, with only one major strike so far during the year and first-year wage settlements throughout the industry averaging below 9%. The one strike at Southwest Forest Industries ended with workers accepting a contract calling for pay increases of 21% over three years—less than the company's original offer before the three-month strike.

Other contracts negotiated in 1982 reflect union members' willingness to settle for less and avert strikes. A two-year contract negotiated at Hammermill's Erie, Pa., mill, called for wage increases of 7%/6%; at Scott's S.D. Warren mill in Muskegon, Maine, a two-year contract with pay hikes of 68¢/7%; Champion International Corp.'s St. Paul, Minn., mill, a three-year agreement of 6%/6%/6%; American Can Co.'s Halsey, Ore., mill, a three-year contract of 9%/7.63%/6.7%.

Only 96 mills throughout the country were set to bargain in 1982, down from 130 the previous year, and at the bottom of what is essentially a three-year bargaining cycle. Bargaining focused on the South where many of the 24 mills with contracts expiring in 1982 are owned by major companies, including International Paper Co., Mead Corp., St. Regis Paper Co., MacMillan Bloedel Inc. and Crown Zellerbach. In other regions of the country, 38 mills were set to bargain in the Midwest; 26 mills in New England; 13 in the Northeast, and 8 on the West Coast.

Bargaining pattern. Bargaining in the U.S. tends to be fragmented both within companies and within regions of the country, although some united efforts at negotiating do exist in the U.S. On the West Coast, the Assn. of Western Pulp & Paper Workers, representing 20,000 employees in the region, has sometimes bargained with large multi-company units.

The largest union of pulp and paper workers in the U.S. is the United Paperworkers International Union, which has 300,000 members, with 297,000 throughout the U.S. and 3000 in Canada. In 1981, UPIU locals ratified contracts calling for an average wage increase of 8.6%. The union's membership is divided within the industry as follows: 125,000 in the primary mills, 139,000 in converting operations, 10,000 in forestry, 25,000 in other sectors and 1000 office workers.

Besides laying off hourly workers, companies have also been trying to curb payroll costs in the recent recession by reducing salaried staff, freezing or cutting

AVERAGE FIRST-YEAR WAGE INCREASES IN U.S. PULP & PAPER INDUSTRY, 1979-81

Region	1981	1980	1979
South	8.2%	8.7%	10.0%
West	9.0	9.8	10.0
Midwest	8.5	9.3	9.5
New England	8.8	10.7	9.6
Northeast	9.0	9.8	9.4
All U.S.	8.7	9.2	9.6

Source: American Paper Institute

U.S. PAPER AND ALLIED PRODUCTS EMPLOYMENT AND EARNINGS

Year	All employees (000)	Production workers (000)	Average hourly earnings	Average weekly earnings
1982*	664.5	496.2	$9.23	$385
1981	687.8	518.0	8.60	365
1980	692.8	522.7	7.84	331
1979	706.8	535.6	7.13	304
1978	698.7	524.7	6.52	280
1977	691.6	518.2	5.96	256
1976	675.5	508.3	5.47	232
1975	642.0	479.7	5.01	208
1974	706.1	544.3	4.53	191
1973	704.6	543.1	4.20	180
1972	688.9	531.6	3.95	169
1971	681.9	521.8	3.67	155
1970	705.5	543.2	3.44	144
1965	639.1	497.7	2.65	114

* For June

Source: Bureau of Labor Statistics

REPRESENTATIVE BASE WAGE RATES FOR REGIONS OF NORTH AMERICA 1970-83

	United States		Canada	
Year	South	West	Eastern	B.C.
1983	—	—	C$12.52	—
1982	$8.56	$11.05	11.38	C$12.96
1981	7.91	9.37	10.16	11.46
1980	7.28	8.53	9.23	9.96
1979	6.74	7.90	7.89	9.06
1978	6.13	7.25	7.46	8.16
1977	5.57	6.59	6.99	7.61
1976	5.04	5.96	6.47	6.89
1975	4.58	5.26	5.88	6.14
1974	4.15	4.78	4.57	5.10
1973	3.78	4.32	4.21	4.45
1972	3.48	4.02	3.85	4.09
1971	3.28	3.76	3.51	3.80
1970	3.09	3.45	3.25	3.50

Source: PULP & PAPER WEEK

management salaries and offering early retirement. To mention just a few such examples, Crown Zellerbach offered some of its employees early retirement and Consolidated-Bathurst Inc. cut 160 of its top and middle management salaries by 10% to 15%.

Bargaining outlook. Bargaining in 1983 is expected to be at the high ebb of the three-year bargaining cycle, with the South alone having 70 mills negotiating. Prospects for companies being in a better position in 1983 to afford high wage increases seem unlikely, at least early in the year. Economists do not foresee a strong rebound in the economy until at least later in 1983 and many analysts expect pulp/paper companies' earnings will continue to decline during 1982-83.

HOURLY EARNINGS OF U.S. PAPER & ALLIED INDUSTRY PRODUCTION WORKERS

($)

	1982	1981	1980	1979
Paper and allied products	9.23[1]	8.60	7.84	7.13
Paper and pulp mills[3]	10.62[2]	10.06	9.15	8.26
Paperboard mills	10.96[2]	10.23	9.28	8.38
Misc. converted paper products	8.05[2]	7.58	6.89	6.31
Paperboard containers/ boxes	8.05[2]	7.53	6.94	6.37
All U.S. manufacturing	8.51[1]	7.99	7.27	6.70

1. For June
2. For May
3. Include construction paper/board mills

Source: Bureau of Labor Statistics

PRODUCTIVITY INDEXES FOR U.S. PAPER & ALLIED PRODUCTS

(output per employee hours; 1977 = 100)

	Production workers	All employees
PULP, PAPER & BOARD MILLS		
1982 (through May)*	108.4	106.3
1981	108.2	107.5
1980	108.1	106.6
1979	106.2	105.4
Average annual percent change		
1978-81	1.9%	2.0%
1978	103.7	103.2
1977	100.0	100.0
1976	95.0	95.0
1975	87.7	86.7
1974	90.5	91.5
1973	90.2	91.5
1970	75.8	77.5
1960	48.8	50.6
1954	37.9	40.4
Average annual percent change		
1947-81	4.1%	3.8%
1973-81	2.9	2.6%
CORRUGATED & SOLID FIBER BOXES		
Average annual percent change		
1958-81	4.3	4.0%
1973-81	3.6	3.3%
FOLDING PAPERBOARD BOXES		
Average annual percent change		
1963-81	2.0%	1.9%
1973-81	0.1%	0.1%

*American Paper Institute data.

Source: Bureau of Labor Statistics

U.S. PAPER WORKERS UNIONS

Union	Region represented	No. of members	No. in primary pulp and paper
United Paperworkers International Union	U.S.	197,000	125,000
Association of Western Pulp & Paper Workers	U.S. west	20,000	20,000

International Assn. of Machinists & Aerospace Workers, International Brotherhood of Electrical Workers, and other major unions have representation at U.S. mills

PULPWOOD COSTS & TIMBER RESOURCES

Pulpwood availability and timber ownership have grown in importance to the paper industry because of growing pressure on available timber supply, particularly softwood.

The U.S. faces an enormous increase in the demand for its wood in the next 50 years. Based on population and economic trends, the Forest Service has projected that demand for lumber, plywood, pulpwood and other timber products will rise from about 14 billion ft³ in 1979 to 22.7 billion ft³ in 2000, with a continuing rise to 28.3 billion ft³ in 2030—roughly doubling in size.

Much of this increase is for pulp products, with pulpwood accounting for over 45% of total demand for roundwood in 2030, compared with about a third in 1976. In addition, demand for fuelwood is also expected to increase due to rising oil and natural gas costs, adding to competition for available wood supplies.

Softwood timber supplies, in particular, are not expected to keep pace with this rising demand, resulting in scarcity and rising prices. However, the extent of the projected future supply/demand imbalance has probably lessened as a result slower economic growth and a lower level of housing starts than anticipated by the Forest Service in its 1980 report, *An Analysis of the Timber Situation in the U.S., 1952-2030.*

U.S. TIMBER RESOURCE

The U.S. has a very large domestic timber resource, with about 737 million acres, 33% of the country's land area, consisting of forest land. Nearly two third of this, or 483 million acres, is classified as commercial timberland, that is, land capable of producing at least 20 ft³ of industrial wood per acre per year and not reserved for uses that are not compatible with timber production.

Farmer and other small private ownerships contain 278 million acres, some 58% of the commercial timberland. Another 69 million acres, or 14%, is owned by the forest products industry. The remaining area, some 136 million acres, or 28% of the total, is in public land. The largest part of this, 89 million acres, is in national forests.

The U.S. commercial timber inventory in 1977 consisted of 792 billion ft³ of roundwood, of which 456 billion ft³ was softwood growing stock and 255 billion ft³ consisted of hardwood. The largest portion of the softwood timber inventory in 1977, some 46% of all softwood growing stock, was in national forests, mostly old-growth stands in the western U.S. About 70% of the hardwood growing stock was on nonindustrial private ownerships, mainly in the East.

Growth/removal trends. The domestic timber resource situation has improved significantly over the last couple decades, according to the Forest Service. For example, between 1952 and 1977 softwood growing stock inventories increased by 11% and hardwoods by 43%. The increase in inventories has been almost entirely on the young stands in the North and South and chiefly on farmer and other private ownerships. Softwood inventories on the forest industry ownerships and the national forest in the Pacific Northwest dropped substantially, the result of harvesting old growth stands.

The increases in inventories reflect net annual timber growth/removal balances. Since 1952, net annual growth of softwoods in the eastern sections of the U.S. has been considerably higher than removals. In 1976, net annual growth of eastern softwood growing stock exceeded removals by 2.6 billion ft³, or 50%, the Forest Service has estimated.

For the western U.S., removals of softwood growing stock in 1976 exceeded net annual growth by 0.3 billion ft³, or 7%. Removals of softwood sawtimber were nearly 30 billion bd ft, over 8 billion bd ft more than net annual growth. Most of the excess of removals over growth was on the forest industry and national forest ownerships in this region.

Net annual growth of eastern hardwoods in 1976 substantially exceeded removals, particularly in the North. For the entire East, net annual growth of hardwood growing stock was 8.7 billion ft³—116%

NET ANNUAL GROWTH AND REMOVALS OF GROWING STOCK ON COMMERCIAL TIMBERLAND IN THE U.S. BY SOFTWOODS AND HARDWOODS AND SECTION, 1952-76

(Million ft³)

Section	All species				Softwoods				Hardwoods			
	1952	1962	1970	1976	1952	1962	1970	1976	1952	1962	1970	1976
North:												
Net growth	3,985	4,741	5,288	5,792	993	1,234	1,362	1,600	2,982	3,507	3,926	4,192
Removals	2,114	2,078	2,472	2,659	635	540	596	705	1,479	1,538	1,876	1,965
Ratio of growth to removals	1.9	2.3	2.1	2.2	1.6	2.3	2.3	2.3	2.0	2.3	2.1	2.1
South:												
Net growth	6,448	7,813	9,576	10,705	3,625	4,680	5,605	6,158	2,823	3,133	3,971	4,547
Removals	5,675	5,525	6,502	6,572	3,112	2,811	3,769	4,472	2,563	2,714	2,733	2,100
Ratio of growth to removals	1.1	1.4	1.5	1.6	1.2	1.7	1.5	1.4	1.1	1.2	1.5	2.2
Rocky Mountain:												
Net growth	1,154	1,319	1,533	1,689	1,097	1,252	1,449	1,589	57	67	84	100
Removals	357	741	892	845	534	738	889	842	3	3	3	3
Ratio of growth to removals	2.1	1.8	1.7	2.0	2.1	1.7	1.6	1.9	19.0	22.3	28.0	33.3
Pacific Coast:												
Net growth	2,326	2,820	3,362	3,478	1,969	2,377	2,823	2,937	357	443	539	541
Removals	3,536	3,615	4,182	4,153	3,489	3,534	4,065	4,027	47	81	117	126
Ratio of growth to removals	.7	.8	.8	.8	.6	.8	.7	.7	7.6	5.5	4.6	4.3
Tota, U.S.:												
Net growth	13,913	16,693	19,759	21,664	7,684	9,543	11,239	12,284	6,229	7,150	8,520	9,380
Removals	11,862	11,959	14,0948	14,229	7,770	7,623	9,319	10,046	4,092	4,336	4,729	4,183
Ratio of growth to removals	1.2	1.4	1.4	1.5	1.0	1.3	1.2	1.2	1.5	1.6	1.8	2.2

Source: U.S. FOrest Service, 1980

above removals—with the greatest part of this surplus growing stock on farmer and other private ownerships.

According to Forest Service data, softwood stumpage prices in the Pacific Northwest and South have been rising faster than the general rate of inflation between 1952 and 1976 (see table). Softwood prices in the northeastern and north central sections of the country have about matched the inflation rate, which has also been true for hardwood in all regions.

Future timber supplies. Current growth/removal balances show that eastern softwood forests and domestic hardwood forests can support additional timber harvests, according to the Forest Service. It projects softwood roundwood supplies will rise from 9.5 billion ft^3 in 1976 to 12.3 billion ft^3 in 2030, an increase of 29%. Although the outlook is for increased softwood supplies nationally, there are important differences among the major softwood timber producing regions.

The projected softwood sawtimber supplies in the Pacific Coast section is expected to drop substantially from 25.2 to 19.6 billion bd ft between 1976 and 2030, with much of the decline occuring by 1990. The major cause of this decline is the physical incapacity of the forest industry lands to maintain current cutting levels. The old-growth inventory in this ownership class is rapidly being depleted, and supplies from merchantable second-growth stands cannot offset the declines.

In contrast to the trends on the Pacific Coast, softwood sawtimber supplies in the South are projected to increase from 18.0 to 27.3 billion bd ft over the same period, mostly on nonindustrial private ownerships. There are also increases in the northern U.S. and Rocky Mountains but on a much smaller scale.

Such major changes in future timber supply for the Pacific Northwest and South will have major impact on the forest products industry in the two regions. Declining timber supplies in the Pacific Northwest will result in closed mills and reduced employments levels in the forest products industry. In the South, the more favorable supply situation indicates future growth for the forest products industry, especially if steps are taken to regenerate softwood stands.

Hardwood roundwood supplies are projected to rise 2.7 times between 1976 and 2030, from 3.3 to 8.9 billion ft^3, with an increasing share in the South.

Future softwood scarcity. "Comparisons of projected increases in timber supplies with projected demands, indicate that the demands are rising faster than the

PROJECTED FUTURE U.S. DEMAND FOR TIMBER PRODUCTS, 1976-2030

Product	Standard unit of measure	Consumption	Projected demands—medium level	
		1976	2000	2030
Lumber	Billion bd ft	42.7	59.9	67.3
Plywood	Billion ft^2 3/8 in. basis	20.7	30.1	34.1
Board (particleboard insulating board and hardboard	Billion ft^2 3/8 in. basis	13.5	27.3	37.3
Pulpwood (U.S. mills)	Million cords	75.2	127.7	178.4
Other industrial products	Million ft^3	379	800	900
Fuelwood (roundwood)	Million cords	8.1	18.7	30.7
Total roundwood, sawtimber	Billion ft^3	13.3	22.7	28.3

Source: U.S. Forest Service, *An Analysis of the Timber Situation in the U.S., 1952-2030*, 1980.

supplies," according to the Forest Service report. "Thus, the outlook is for a growing imbalance between the quantity of timber that people would like to consume and supply."

The prospective imbalances are largest for softwood timber. Projected demands on domestic forests for softwood rise from actual consumption of 9.2 billion ft^3 in 1976 to 13.8 billion by 2000 and 15.7 billion by 2030. Projected supplies of softwood roundwood from domestic forests show moderate increases from 9.2 billion ft^3 in 1976 to 11.1 billion in 2000 and 12.3 billion by 2030.

"It is evident from these comparisons that a substantial rise in the relative prices of softwood stumpage and most softwood timber products beyond the levels assumed in preparing base level projections will be necessary to balance demand and supplies in future decades," the Forest Service said.

PRICES AND MARKETING

To bring about equilibrium in supply and demand, softwood stumpage prices will have to rise substantially in all regions, according to the Forest Service projections. In the South, stumpage prices measured in constant 1967 dollars rise at an average 2.5%/year above the rate of inflation between 1976 and 2030. This is above the 1.8% rate projected for the Pacific Northwest Douglas fir region and the 1.9% rate for the north central and eastern sections of the U.S.

The supply/demand outlook for hardwood is much more favorable than for softwood and it appears supplies will be adequate to meet demand for the next two or three decades. As a result, there may not be much increase in hardwood stumpage prices (adjusted for inflation) in the years immediately ahead.

Intensive forestry. "The adverse impacts associated with economic scarcity and rising rrelative prices of stumpage and timber products are not inevitable," according to the Forest Service. "There are large opporunities to increase and extend timber supplies.

In 1976, average net annual timber growth per acre on all ownerships was only about three-fifths of that attainable in fully stocked natural stands. With the use of genetically improved trees, fertilization, spacing control, and other intensive management measures, much greater growth can be achieved. In addition, there are substantial opportunities for extending timber supply through more efficient harvesting and processing techniques.

Pulpwood market. About one third of all timber currently harvested in the U.S. is used as pulpwood, with about 60% of this in the form of roundwood and the remainder in the form of chip residuals from wood products manufacturing. The cost of delivered pulpwood, which includes a significant labor component, accounts for roughly 25% of paper industry manufacturing costs.

RECENT SOUTHERN U.S. PULPWOOD COST TRENDS[1]

	Roundwood[2] ($/cord)		Chips[3] ($/short ton)	
	Softwood	Hardwood	Softwood	Hardwood
1982				
1st qtr	$42.00	$31.33	$22.23	$16.02
2nd qtr	43.37	31.77	22.96	16.40
First half	42.69	31.55	22.60	16.21
% change 1982/81	+ 6.2%	+ 4.0%	+ 6.2%	+ 5.7%
1981				
1st qtr	40.06	30.71	20.73	15.10
2nd qtr	40.35	29.98	21.85	15.56
3rd qtr	40.90	30.56	21.71	15.67
4th qtr	41.04	30.62	21.85	14.62
Year	40.59	30.47	21.54	15.24
% change 1980/81	+ 2.2%	+ 9.9%	+ 14.8%	+ 5.2%
1980				
1st qtr	38.25	30.45	18.27	14.28
2nd qtr	39.72	30.90	18.42	14.49
3rd qtr	40.17	30.85	18.87	14.57
4th qtr	40.67	30.99	19.50	14.58
Year	39.70	30.80	18.77	14.48
% change 1980/79	+ 7.2%	+ 6.9%	+ 19.1%	+ 13.2%
1979				
1st qtr	35.93	27.86	14.82	12.67
2nd qtr	36.64	28.02	15.17	12.58
3rd qtr	37.41	29.33	16.29	12.90
4th qtr	38.17	30.01	16.74	13.02
Year	37.04	28.81	15.76	12.79

1. Average for 13 southern states
2. Gate price f.o.b. yard; no gate or yard cost included.
3. Clean chips, f.o.b. mill or chipping plant

Source: Timber Mart-South

U.S. pulpwood consumption in 1981 totaled 79.7 million cords (128 ft^3) which was about the same level as recorded in 1980 and 1979 by the American Pulpwood Assn. Through the first half of 1982, pulpwood consumption was down 1.8% from a year earlier, reflecting the impact of the recession on pulp and paper mill operating rates.

The recession also had affect of decelerating the rate of increase in pulpwood prices, which in 1979-80 appeared to be rising at a faster rate than inflation in some parts of the U.S. However, data compiled by Arthur D. Little shows very little increase in U.S. pulpwood costs over the past decade, adjusted for inflation, with the exception of the Pacific Northwest (see table).

HISTORIC TRENDS IN U.S. PULPWOOD COSTS

(Current and constant $/metric dry ton delivered)

		U.S. South		Wisconsin		New Hampshire	
Oregon	Southern Softwood Chips[1]	Southern pine pulpwood[2]	hardwood pulpwood[2]	Pine pulpwood[3]	Aspen pulpwood[3]	Spruce pulpwood[3]	Hardwood pulpwood[3]
1981	$81.37	$53.17	$42.17	$48.19	$38.55	$55.57	$40.34
1980	88.44	49.01	41.78	47.57	37.02	52.16	38.04
1979	42.55	46.70	40.37	45.70	33.91	49.90	33.92
1978	42.98	42.65	36.93	37.14	33.74	44.23	32.08
1977	43.34	40.01	35.93	35.72	28.63	41.39	30.25
1976	39.90	38.91	34.92	33.68	28.07	35.72	28.97
1975	34.74	37.77	35.02	33.45	32.89	35.72	28.97
1974	26.50	36.94	33.92	31.75	30.34	34.59	26.13
1973	24.85	29.79	29.34	29.60	27.22	34.02	24.29
1972	22.12	26.81	26.58	26.25	24.72	25.52	21.54

1. Based on 1 cord=220 lb. or 0.98 Bdu
2. Based on 1 cord=2400 lb, bonedry without bark
3. Based on 1 cord=1940 lb, bonedry without bark

Source: Arthur D. Little Inc., based on data from U.S. Forest Service; Dept. of Commerce; Louisiana State Dept. of Agriculture; University of Wisconsin, Forestry Department; University of New Hampshire, Cooperative Extension Service

INDEXES OF TREND LEVEL SOFTWOOD STUMPAGE PRICES IN THE U.S. BY REGIONS, 1952-76 WITH PROJECTIONS OF EQUILIBRIUM PRICES TO 2030[1],[2],[3]

(Indexes of prices/thousand bd ft international ¼-inch-log rule—1967=100)

					Projected indexes of equilibrium prices[3]				
Region	1952	1962	1970	1976	1980	2000	2010	2020	2030
Northeast	100.0	100.0	100.0	100.0	168.1	185.1	213.6	245.3	279.5
North Central	100.0	100.0	100.0	100.0	154.0	180.9	207.3	238.9	279.0
Southeast	57.8	83.3	111.6	138.9	229.6	280.0	358.0	434.6	526.8
South Central	57.8	83.3	111.6	138.9	230.6	281.6	358.5	434.3	524.7
Rocky Mountains	58.0	83.5	111.5	138.7	473.0	514.4	704.1	859.7	1045.0
Pacific Northwest:									
Douglas-fir subregion (Western Washington and western Oregon)	43.8	75.9	118.0	164.2	275.0	228.2	287.4	355.8	430.3
Ponderosa pine subregion (Eastern Washington and eastern Oregon)	80.6	93.1	104.4	113.8	300.5	330.6	425.1	500.8	608.1
Pacific Southwest	52.9	80.9	113.6	146.5	300.8	334.7	416.3	490.2	579.9

1. Indexes of prices on a least squares regression line fitted to time series price data for the years 1950-76.
2. Prices are measured in constant (1967) dollars and are net of inflation or deflation. They measure prices changes relative to the general price level and most competing materials.
3. Indexes of the prices which would result from stumpage prices rising enought to maintain an equilibrium between projected timber demands and supplies.

Source: U.S. Forest Service, 1980.

REGIONAL WOOD SUPPLY

U.S. South. About 72% of the commercial timberland in the South is owned by private landowners; however, this land yields only about 60% of the timber harvested due primarily to poor forest-management techniques. As a result, paper companies have been trying to encourage better forest management practices among small landowners.

Roundwood pulpwood supplies over 60% of the region's pulp and paper fiber requirements, with the remaining 40% from wood manufacturing residues, up from about 10% in 1960. Pulpwood consumption by the South Atlantic states totaled 24.8 million cords last year, while the South Central states consumed another 27.7 million cords.

Despite a hefty annual growth rate for softwood stock, rising demand is expected to cause occasional localized timber shortages during the 1980s, according to an analysis by Arthur D. Little Inc. However, such shortages will generally be confined to particular species and sizes of trees and will be alleviated through increases in delivered sawlog and pulpwood prices. Overall supply of both softwood and hardwood is expected to be adequate to meet the requirements of at least the 1980s.

According to data collected by Timber Mart-South, softwood chip costs in the South jumped 19% in 1980 and 15% in 1981 before slowing to a 6% rise in the first half of 1982 compared to year ago levels. The fairly rapid rate of increase may have partly reflected some contraction in byproduct chip supplies due to curtailment of lumber and plywood mills. By comparison, softwood roundwood prices only increased 7% in 1980, 2% in 1981 and 6% for the first half of 1982. Roundwood costs show some regional variation and are highest in Florida, Alabama, Georgia, and Louisiana where a heavy concentration of pulp and paper mills are located. Lower pulpwood cost areas include Kentucky, North and South Carolina and Mississippi, according to the Timber Mart-South data.

Chip exports from the South to Europe began to develop about five years ago as pulp mills in Scandinavian began to reach the limits of their domestic wood supplies. U.S. woodchip shipments, mostly from the South, to Scandinavia in 1981 totaled 739,000 short tons.

Northern U.S. Private landowners own most of the timberland and supply roughly 80% of the timber harvested—primarily hardwoods—in the northeast and Great Lakes regions. Demand for forest products is fairly stable as timber production is not the primary goal of the region's landowners.

Pulpwood is supplied mostly in roundwood form, with growth far exceeding demand. Pulpwood consumption in the Northeast totaled 7.7 million cords, while consumption in the North Central states totaled 5.7 million cords in 1981, according to APA data. Despite the inroads being made on timber supply by firewood and biomass applications, as well as waferboard production, growth is still expected to outstrip demand through 1990.

U.S. Pacific Northwest. In the Pacific Northwest, public agencies own slightly over half of the forestland. Unlike other areas of the country, the bulk of pulp and paper fiber requirements—roughly 75%—is supplied from wood products manufacturing residuals. Pulpwood consumption in the region totaled 13.9 million cords in 1981. In addition, about 2.8 million short tons of chips were exported from the Pacific Northwest, almost entirely to Japan.

The heavy dependence of the Pacific Northwest industry on residuals contributed to a sharp rise in pulpwood costs in 1980 as downturn in new home construction caused lumber and plywood plants in the region to take heavy downtime, cutting of the flow of byproduct chips. Domestic and export demand for chips from the pulp and paper industry was still strong at this time, causing chip prices to skyrocket.

Pacific Northwest export prices for Douglas fir chips to Japanese mills jumped from about $55/bone-dry unit in the second half of 1979 to a peak of $131 in the second quarter of 1980, but have subsequently eased to about $102/unit for the second half of 1982. Purchased

U.S. COMMERCIAL FORESTLAND BY OWNERSHIP, 1981

(000 acres)

Region	Forest industry	Other private	National forests	Other public	All ownerships
South	35,754	134,937	10,955	6,788	188,433
Pacific Northwest	12,349	14,035	31,496	12,879	70,758
North	17,777	121,674	10,121	21,197	170,769
Rocky Mountain	2,096	12,502	36,436	6,732	57,765
All regions	67,976	283,149	89,007	47,595	487,726

Source: U.S. Forest Service

U.S. PULPWOOD RECEIPTS AND CONSUMPTION

(000 standard cords, rough wood basis)

	1981p	1980p	1979	1978	1977	1976	1975	1974	1972	1970
Receipts, total	79,345	81,007	76,928	74,824	72,867	72,265	65,456	77,103	70,273	68,863
Domestic	78,581	80,320	76,124	73,970	72,094	71,443	64,836	76,262	69,254	67,723
Softwoods		59,582	56,741	54,803	54,680	53,689	48,759	55,531	51,793	53,356
Hardwoods		20,738	19,383	19,167	17,414	17,753	16,079	658	17,461	16,367
Imported	833	687	804	854	773	882	618	841	1,020	1,140
Softwoods		588	698	764	709	744	521	658	884	994
Hardwoods		99	106	90	65	78	96	183	135	140
Northeast	7,803	7,159	6,777	6,802	5,887	5,712	5,320	6,547	5,398	5,958
North Central		5,969	5,956	5,522	5,364	5,441	4,574	6,401	4,935	5,245
South Atlantic	24,681			25,353			19,907	23,414	22,334	21,835
South Central	27,774			25,678			22,151	24,953	23,113	20,493
West	7,712	16,496	14,477	13,483	14,937	14,766	13,504	15,986	14,492	15,367
Consumption, total	79,456	79,703	77,362	74,170	73,935	72,011	65,421	74,327	71,538	67,562
Northeast	7,712	7,318	6,748	6,501	5,949	5,877	5,417	6,149	5,878	5,699
North Central	5,708	5,715	5,728	5,492	5,473	5,442	4,779	5,678	5,222	5,034
South Atlantic	24,815	24,960	24,426	23,703	22,817	22,673	19,983	22,926	22,395	21,511
South Central	27,687	26,246	25,421	25,118	24,668	24,969	22,042	22,240	23,212	20,458
West	13,682	15,465	15,038	12,784	15,063	14,247	13,200	15,466	14,831	14,822

Source: Bureau of Census, from Current Industrial Reports Series M26A

U.S. EXPORTS AND VALUE OF WOODCHIPS

	Quantity		Value	Average value	
	short tons	metric tons	$	$/short ton	$/metric ton
1981	3,545,951	3,216,816	290,184,105	$81.84	$90.21
1980	4,478,234	4,062,564	377,899,701	84.39	93.02
1979	4,498,674	4,081,107	197,846,642	43.98	48.48
1978	3,617,574	3,281,791	156,679,856	43.32	47.74
1977	4,037,901	3,663,103	178,223,078	44.14	48.65
1976	3,946,817	3,580,473	153,001,887	38.77	42.73
1975	3,177,204	2,882,296	115,384,797	36.32	40.03
1974	3,865,780	3,506,958	113,929,564	29.47	32.49
1973	3,480,840	3,157,748	85,727,159	24.03	27.15
1972	2,524,415	2,290,099	57,070,248	22.61	24.92
1971	1,978,731	1,795,065	41,123,878	20.69	22.91
1970	2,418,161	2,193,707	36,634,138	15.15	16.70

Source: Bureau of the Census

chip costs for domestic pulp and paper mills also followed this general trend, significantly raising the cost structure for the Pacific Northwest industry and putting mills there at a competitive disadvantage with those in the South and other regions of the U.S. where wood costs may in some cases be only half as much.

While the expected recovery in housing construction in 1983 should cause chip prices to decline further, the pulpwood supply outlook for the region is still not positive. As indicated above, timber removals are exceeding growth in the important softwood-growing Pacific Northwest region, particularly on industry lands. Harvest levels from national forestlands in the region have shown an erratic and declining trend in recent years because of inadequate Forest Service funding, conservative "evenflow" forest-management practices, and wilderness setasides.

COMPANY HOLDINGS

Of the forest industry companies which own roughly 70 million acres of timberland in the U.S., International Paper Co. is the largest landowner on an acreage basis, with 7.0 million acres in the U.S., primarily in the South. Weyerhaeuser Co. is second with 5.9 million acres, and Georgia-Pacific Corp. third with 4.2 million acres (see table). Because of regional variations in timber stocking density, however, Weyerhaeuser leads in total timber inventory with 10.8 billion ft^3, followed by IP with 8.5 billion ft^3 and G-P with 6.0 billion ft^3, according to recent estimates by Morgan Stanley & Co.

In Canada, about 87% of forestland is Crown land owned by the provincial and federal governments, with only about 5% in private ownership. Among forest products companies, Fraser Cos. has the largest holdings with 766,000 acres, followed by MacMillan Bloedel Ltd. with 556,000 acres.

In addition to land ownership, many companies control, through long-term leases, private timberland and cutting rights thereon. Weyerhaeuser controls an additional 9.1 million acres of timberland in Canada, while other large holders of controlled land in both the U.S. and Canada include Domtar Inc., with 10 million acres, Kimberly-Clark Corp. with 11.8 million acres, and Boise Cascade Corp., with 4.2 million acres. Mead Corp. controls 2 million acres in Canada and 101,000 acres in the U.S., and MacMillan Bloedel controls 2.1 million acres in Canada and 269,000 in the U.S.

ENERGY USE AND CONSERVATION

The pulp and paper industry is highly energy-intensive, ranking third after primary metals and chemicals in purchased energy consumption and accounting for about 3% of total U.S. energy consumption.

It requires an average of 30 million Btus to manufacture a ton of pulp and paper: about 40% is required in the chipping and pulping operations, another 40% in drying and finishing, and the remaining 20% in bleaching, washing and refining stages.

The industry is unique in that a significant portion of its total energy requirements come from self-generated and waste fuels, such as spent pulping liquors and woodwaste. At the same time, pulp and paper manufacturers have made significant progress in reducing their requirements for fossil fuels and other forms of purchased energy.

CHANGES IN ENERGY USE AND PRODUCTION FOR SELECTED INDUSTRIES, 1972-80

(% change)

Industry	Production	Purchased energy use
Paper	+10.6%	−11.0%
Iron & steel	−11.5	−24.2
Textiles	+ 2.0	−15.6
Petroleum	+ 5.9	− 5.7
Total U.S. economy	+24.9*	+ 6.3

* Real GNP (1972)

Source: American Paper Institute from other trade association, Dept. of Commerce data

Fuel use varies substantially from region to region. For example, mills in the New England/mid-Atlantic region are relatively more dependent on fuel oils; the north-central region is more dependent on coal; while the southeast and northwest regions rely more on wood-based energy sources.

Between 1972 and 1981, the industry slashed its use of fossil fuels and purchased energy per ton of product by 30.4%, after adjustments made for capacity utilization rates, fuel mix, and environmental requirements—all of which affect energy consumption, according to the American Paper Institute. Concurrently, the paper industry has increased its paper and paperboard output by almost 18% and reduced its purchased energy requirements by over 11% and its consumption of oil by 40%.

Under the pressure of energy price increases, the industry expects to further decrease its reliance on purchased energy by using more self-generated and waste fuels and by improving process efficiencies.

Energy use pattern. The proportion of the industry's total energy derived from self-generated or waste fuels has grown from 40.5% in 1972 to 50.1% in 1981. This represents a saving equivalent to 29 million barrels of oil in 1981, or about six days of current oil imports.

Among the self-generated fuels, spent pulping liquors are the single largest source of energy, accounting for 37.6% of the industry's total energy use in 1981, up from 33.7% in 1972. Use of hogged fuel (woodwaste) has more than tripled over the period, from 2.0% to 6.7% in 1981. Use of bark has risen slightly from 4.6% in 1972 to 5.0% in 1981. Orders for boilers placed by the pulp and paper industry in 1980 indicate that wood residues and spent pulping liquor will be the primary fuels for 71% of the industry's total new steam capacity.

Consumption of fossil fuels and other purchased energy showed a corresponding decline during the period, from 59.1% in 1972 to 49.9% in 1981. Residual and distillate fuel oil comprised 12.6% of total energy consumed in 1981, down from 22.3% nine years earlier. Because natural gas has become more interruptible for industrial boiler use, the pulp and paper industry cut its reliance on this fuel from 21.5% of the 1972 total to 18.7% in 1981. However, consumption of natural gas by the paper industry has recently been on the rise, and in 1981 its natural gas use rose 8% over 1980 levels.

Coal use dropped from 9.8% in 1972 to a low of 8.9% in 1978, reflecting the impact of more stringent air-quality standards. But coal use increased to 11.2% in 1981, and the rising trend is expected to continue and accelerate.

The rise in purchased electricity use from 4.4% of total energy in 1972 to 6.5% in 1981 may reflect growth of mechanical pulping processes, which use more electricity, and increased electrical requirements for environmental equipment. The paper industry's electricity bill in 1981 was $1.8 billion. As the largest cogenerator of electricity in the U.S., accounting for close to 50% of the total industrial cogeneration capacity today, or roughly 3000 megawatts of power, the paper industry also sells some electrical energy. Some 37% of the paper industry's own electricity demand is cogenerated, representing an annual fuel savings of 22 million barrels of oil.

Despite the progress being made in energy conservation, the U.S. paper industry's purchased energy costs have risen sharply, from 7.0% of total shipments in 1972 to 13.8% in 1981, according to Bureau of Census data.

Rising energy costs have a varying impact on diffferent segments of the paper industry. Newsprint made mainly from thermomechanical pulp requires a high amount of energy per ton of production which is supplied by purchased electricity and fossil fuel (although some woodwaste may be burned). Unbleached kraft linerboard has lower total energy requirements per ton than newsprint, and roughly half of this energy may come from burning black liquor. Recycled grades require considerably less total energy per ton to produce than virgin paper and paperboard but must rely entirely on purchased fossil fuel and electricity. Purchased energy requirements for recycled newsprint are lower than for newsprint made from TMP, but are probably higher for recycled linerboard than for kraft linerboard. Thus, recycled paper and board production does not necessarily conserve energy—at least not for purchased fossil fuels and electricity.

To reduce the impact of rising oil and natural gas costs, the U.S. paper industry has been installing a large number of coal and woodwaste boilers even though such solid fuel boilers may cost roughly twice as much as oil-burning units. The recent weakening in fuel oil costs plus the strained financial condition of many companies has led to some slowing in such projects, although PULP & PAPER PROJECT REPORT in mid-1982 listed 40 projects either under study or construction at U.S. mills to install mainly coal or woodwaste boilers. Even with the recent weakness in fuel oil prices, the payback on such project is probably fairly attractive and has the effect of diverting paper industry capital spending into cost reduction rather than capacity expansion.

U.S. PULP AND PAPER INDUSTRY'S PURCHASED ENERGY COSTS AS PERCENTAGE OF SHIPMENTS

(millions of $)

	Purchased energy costs*	Value of shipments	As percentage of shipments
1981p	$4,700	$34,171	13.8%
1980p	4,000	31,952	12.5
1979p	3,270	28,771	11.4
1978	2,705	23,797	11.4
1978	2,650	25,343	10.5
1977	2,560	23,701	10.8
1976	2,185	21,062	10.3
1975	1,876	17,334	10.8
1974	1,647	17,933	9.2
1973	950	13,463	7.1
1972	799	11,374	7.0

* Includes electric energy, fuel oil, coal, natural gas and other fossil fuels

Source: American Paper Institute and Bureau of Census

U.S. PULP AND PAPER INDUSTRY ESTIMATED FUEL AND ENERGY USE, 1981 and 1972

Source	1981 Consumption (trillion Btus)	% of total	1972 Consumption (trillion Btus)	% of total
Purchased electricity	141	6.5%	92	4.3%
Purchased steam	15	0.7	22	1.1
Coal	244	11.2	226	10.7
Residual fuel oil	265	12.2	452	21.4
Distillate fuel oil	8	0.4	22	1.1
Liquid propane gas	2	0.1	3	0.1
Natural gas	405	18.7	438	20.7
Other purchased energy	3	0.1	2	0.1
Energy sold	(−22)	0.0	(−13)	0.0
Total purchased fossil fuel and energy	1061	49.9	1243	59.5
Hogged fuel, 50% moisture	145	6.7	43	2.0
Bark, 50% moisture	109	5.0	97	4.6
Spent liquor, solids	816	37.6	704	33.3
Self-generated hydroelectric	9	0.4	9	0.4
Other self-generated energy	9	0.4	3	0.2
Total self-generated and waste fuels	1089	50.1	856	40.5
Total energy	2149	100.0	2099	100.0

Source: American Paper Institute

CHEMICALS

Most major chemicals used in the paper industry became highly available as 1982 progressed and prices continued a decelerating trend begun in 1981. This was of considerable benefit to the paper industry since chemicals account for about 10% to 12% of total manufacturing costs and have been rising at a faster rate than prices on paper and allied products.

Prices for industrial chemicals rose 14.7% in 1980 from a year earlier, then slowed to a 9.0% increase in 1981 and as of June 1982 were down 3.2% from the first of the year, according to Bureau of Labor Statistics data. Chloralkali prices have risen at a particularly rapid rate, soaring 66.8% for this two-and-a-half year period, with caustic soda shooting up 127.5%, while chlorine rose only 5.6%.

International Paper Co. noted that its chemical costs in 1981 jumped by 18% due to the sharp price increase for caustic soda. Chloralkali producers have been under intense energy cost pressure, and this has been passed on mainly to caustic soda customers since demand for chlorine has been weak. This imbalance in demand between the two co-products also contributed to a tight caustic soda market which had some pulp mills scrambling for supplies until the recession weakened demand for caustic in early 1982. Caustic soda (sodium hydroxide) is mainly used by kraft and bleached sulfite pulp mills for caustic extraction, while the major use for chlorine is as a bleaching agent.

Sulfur has also shot up rapidly in price, with the tight 1979-81 market easing as new capacity came on-

CHEMICAL CONSUMPTION BY U.S. PULP & PAPER ESTABLISHMENTS IN 1977*

	Quantity (000 short tons)	Delivered cost (millions $)
Sulfur	308.6	$ 18.4
Chlorine	1268.5	148.9
Sodium hydroxide (caustic soda) (100% NaOH)	2026.7	255.9
Sodium carbonate (soda ash) (98% to 100%)	193.9	17.8
Sodium sulfate, incl. saltcake (100% Na_2SO_4)	1124.4	75.4
Aluminum sulfate (17% Al_2O_3)	553.0	45.7
Titanium dioxide	129.7	119.8
Rosin sizing	134.3	71.5
Lime	1247.4	54.9
Kaolin & ball clay	1618.1	122.9
Starch	684.0	149.2

* For pulp, paper and paperboard mills only (SIC 2611, 2621, 2631)

Source: Bureau of the Census

ESTIMATED U.S. PAPER INDUSTRY CONSUMPTION OF SELECTED MAJOR CHEMICALS, 1981

Chemical	Paper industry consumption	% of total U.S. consumption	Applications in paper industry
Pulping/bleaching			
Caustic soda	2.3 million tons	17%	used for caustic extraction in kraft bleached sulfite pulp mills
Chlorine	1.5 million tons	13	main use is as bleaching agent in kraft, sulfite pulp mills
Sodium sulfate (saltcake)	612,000 tons	48	main source of makeup sodium & sulfur in kraft pulp mills
Sulfur	100,000 tons	1	mostly used in sulfite pulping, although some used directly in kraft pulping
Sodium chlorate	283,000 tons	82	used in on-site chlorine dioxide generation for bleaching
Lime	975,000 tons	5	used for causticizing sodium carbonate in kraft recovery process
Sodium hydrosulfite*	16,700 tons	30	bleaching agent for mechanical, deinked pulps
Hydrogen peroxide	13,000 tons	12	traditional bleaching agent for chemical, mechanical pulps; finding increased use in deinking newsprint
Pigments/filler/sizing			
Aluminum sulfate	656,000 tons	50	mostly for precipitation of rosin size; also pitch control, water treatment
Kaolin clay	3.0 million tons	75	about 60% is used in Filler applications; the remainder for coating
Titanium dioxide	360 million lbs	23	both anatase & rutile grades used as filler and in coatings
Starch	3.0 billion lb	66	traditional binder for paper coating
Styrene-butadiene latex	222 million lb	38	major use is as a coating binder
Polyvinyl alcohol	10.8 million lb	8	mainly used for surface sizing printing/writing papers and also in coating
Calcium carbonate	140,000 tons	n.a.	mostly used for coating but also as a filler

* Excludes on-site production via Borol process.

Source: PULP & PAPER estimates

stream and the major market for sulfur in fertilizer weakened. Sulfur is used mainly by sulfite pulp mills, but some quanitites are used direectly in kraft pulping. Sodium chlorate, which is used by pulp mills to generate chlorine dioxide for bleaching, has been growing at about a 7%/year rate, but significant capacity additions have kept the market loose. Saltcake (sodium sulfate) has been in available supply and its future growth will probably be limited by the spread of chlorine dioxide bleaching, which generates sodium and sulfur that can be used to replace purchased saltcake.

Hydrogen peroxide has primarily been used as a bleaching agent for chemical and mechanical pulps but is finding increased use in the deinking of recycled newsprint. Its use in the paper industry is expected to grow at something like an 8%/year pace into the mid-1980s. Another bleaching agent that is showing fairly rapid growth is sodium hydrosulfite, used mainly for bleaching mechanical and deinked pulps.

Kaolin clay has been affected by the recession, although demand has been helped by the recent sharp expansion of U.S. coated paper capacity. The titanium dioxide market remained surprisingly strong until 1982 when some discounting in prices was reported. Calcium carbonate is mainly used for paper coating, with ultrafine grades finding increased usage as a lower cost replacement for some titanium dioxide. Prices have only shown moderate growth, while supplies have been available.

Corn, wheat, tapioca and potato starches have traditionally been the most important binders used for paper coating, although styrene-butadiene latex has been increasing in importance. Sharply rising petrochemical feedstock costs have caused a sharp rise in S-B latex prices and at least temporarily slowed penetration into the paper binder market. Polyvinyl alcohol (PVA) is used in the paper industry as a surface size for printing/writing papers and to some extent in paper coating. Demand from the paper industry may grow about 4%/year, while supplies are expected to remain adequate.

PRICE TRENDS FOR MAJOR CHEMICALS USED IN THE U.S. PULP & PAPER INDUSTRY

(f.o.b. producing plant)

	Unit	1981	1980	1979	1978
Calcium carbonate (precipitated)	$/ton	$95-140	$105-135	$98-123	$95-133
Caustic soda (50% solution)	$/ton	270-320	167-200	130-160	160-170
Chlorine	$/ton	80-110*	145	135-150	135-145
Hydrogen peroxide (70% solution)	¢/lb	35.6-39.5	35.5-36.5	32.5	28
Kaolin clay (premium No. 1 coating)	$/ton	130	118	108	98
Lime	$/ton	52	46	41	37
Polyvinyl alcohol	¢/lb	100-105	86.5-91.5	77.5	69.5
Saltcake (sodium sulfate)	$/ton	68-79	60-68	47-52	35-45
Sodium chlorate	$/ton	375	345-375	355-345	345
Sodium hydrosulfite	¢/lb	52	49	47	45.5
Starch (unmodified)	$/100 lb	12.25	9.50-10.50	9-10	8
Styrene-butadiene latex	¢/lb	65-75	59	53	40-43
Sulfur	$/long ton	134	105-121	72	63
Titanium dioxide (anatase)	¢/lb	58-70	57	53	46

*Reflects discounting from list.

Source: PULP & PAPER

TRANSPORTATION

U.S. pulp and paper producers move more than 70% of their shipments by rail, although use of trucks is probably growing.

In 1981, U.S. carloadings of pulp, paper and allied products totaled 996,000 cars, down 6.3% or 63,300 cars from the previous year, reflecting the impact of the recession. This placed the industry in fifth place among major industrial rail shippers, accounting for 4.6% of all carloadings. If primary forest, lumber and wood products are included, the entire forest products industry ranked second only to coal in total 1981 carloadings and accounted for 10.8% of total loadings.

Pulp, paper and allied products carloadings are likely to be down 15% or more in 1982, following a 6% decline in 1981 and a 3.3% drop in 1980. Lumber and wood product carloadings have dropped off even more sharply from a peak of 675 to 1977 to 397 in 1981 and will show another substantial drop in 1982 due to the depression in new home construction.

U.S. railroad freight rates rose sharply in the 1979-81 period reflecting the need of railroads to pass through higher energy costs and their greater freedom to increase rates with deregulation. The rail freight index for pulp, paper and allied products jumped 13.3% in 1979, 18.4% in 1980 and 15.9% in 1981, according to Bureau of Labor Statistics data. Slumping shipping volume in the first half of 1982, however, caused rates to decelerate sharply and for June were only up 7.9% from June 1981.

Although no index is available for ocean shipping, rates also increased sharply over the 1979-81 period, but weakened in the recession due to increased competition among shipping lines. The cost of shipping pulp and paper from Atlantic mills to northern European ports is estimated at around $70 to $80/metric ton. The cost of shipping to the Far East from West Coast U.S. mills is roughly similar and less than the cost of shipping by rail to northeastern markets which are more effectively served by mills in the South and eastern Canada. This has gradually contributed to an increasing export orientation for West Coast mills.

U.S. RAILROAD FREIGHT PRICE INDEX

(1969 = 100)

	Pulp, paper & allied	% change from previous year
June 1982	326.2	7.9%
1981	306.5	15.9
1980	264.5	18.4
1979	223.4	13.3
1978	197.1	5.6
1977	186.5	5.9
1976	176.1	8.2
1975	162.7	13.4
1974	143.5	15.3
1973	124.5	0.3
1972	124.1	1.4
1970	122.4	12.3
1970	108.9	8.9

Source: Bureau of Labor Statistics

CARLOADING OF MAJOR U.S. RAILROADS, 1976-81

(000 cars loaded)

	1981	1980	1979	1978	1977	1976
Pulp, paper & alied	996	1,060	1,097	1,094	1,103	1,101
Primary forest products	939	1,002	1,055	1,086	1,112	1,139
Lumber & wood products	397	469	597	649	675	670
Total forest products	2,332	2,531	2,749	2,829	2,890	2,910
Al rail carloadings	21,618	22,598	23,876	23,373	23,173	23,457

Source: Assn. of American Railroads

RESEARCH & DEVELOPMENT SPENDING

Pulp and paper manufacturing is a mature technology and the industry is not a heavy spender on research and development. In 1981, 19 U.S. paper companies for which data were available had R&D outlays amounting to to 0.8% of sales, compared with an average of about 2.46% for all U.S. industry. In the paper industry R&D spending per employee was $915 in 1981, compared with an average of $1988 for all types of business.

For 1982, the paper industry was planning to boost R&D outlays by 12% to $654 million, vs a 17% boost by all U.S. industry, according to a survey taken by McGraw-Hill. However, over the next three years, paper companies plan to lift outlays another 36% to $892 million, nearly matching the 37% increase planned by all industry for the same period. Of the total amount for 1982 R&D outlays planned by the paper industry, only 0.8% will be funded by federal support, compared with all U.S. industry, which receives an estimated 32% of its total funding from the federal government.

Helping to stimulate R&D spending are tax measures passed by Congress in 1981. The Economic Recovery Tax Act legislated in August 1981 gives firms a 25% tax credit for R&D expenditures in excess of the average spent in the three previous years. In addition, the act included faster writeoff of plant and equipment, and equipment used for R&D purchased after December 31, 1980 may be written off in three years.

More important in spurring R&D activity by the paper industry, however, should be competitive inroads by the plastics and electronics industries, both of which have higher levels of research spending. Dr. Edwin A. Gee, chairman and CEO of International Paper Co. and a former DuPont executive, points out that R&D spending in the chemical industry is about 3% vs less than 1% for paper. "We must better exploit our nature-given opportunities by building an R&D base that will give us a technological edge," he said. "This could provide us with a long-term advantage over the chemical industry, based as it is on nonrenewable resources."

Among subjects high on research agendas in the paper industry are forest genetics and reforestation techniques, wholetree utilization, pulpmaking processes utilizing hardwoods, water- and air-quality analyses and control, improved energy use and recovery technology, new types of wet- and dry-forming of paper, computer process control, use of chemicals and fuel from byproducts and waste, and coating and packaging technologies—to name a few.

Industry leader in R&D spending is Weyerhaeuser Co., which spent $54 million in 1981, amounting to 1.2% of its total 1981 sales. Competing in a fiercely competitive market which emphasizes product innovation, tissue companies are high in ratios of R&D/sales, which in 1981 came to 1.4% for Scott Paper Co. and 1.3% for Kimberly-Clark Corp. Mead, Union Camp, and Westvaco also score high in R&D/sales, although part of this goes to increasing nonpaper activities such as electronics and chemicals.

A significant amount of pulp and paper research is also performed by supplier companies as well as by university and government institutes. Suppliers that perform a substantial amount of research work for the industry include manufacturers of pulp and papermaking equipment, felts and fabrics, computer control systems, and chemicals.

Leading research institutes specializing in paper science include the Institute of Paper Chemistry at Appleton, Wis., U.S. Forest Products Laboratory at Madison, Wis., and Pulp & Paper Research Institute of Canada at Pointe Claire, Que.

U.S. PAPER INDUSTRY R&D SPENDING vs. OTHER MAJOR INDUSTRIES

(millions of $)

	1980*	1981	Planned		1981-82	1982-5
Industry	**Estimated**	**Estimated**	**1982**	**1985**	**% change**	**% change**
Iron & steel	$ 318	$ 318	$ 350	$ 466	10.0%	33.0%
Nonferrous metals	375	471	507	614	7.6	21.1
Electrical machinery	9,137	10,511	12,949	18,931	23.2	46.2
Machinery	6,076	7,458	8,939	11,584	21.0	29.6
Autos, trucks & parts	4,843	5,411	6,270	9,316	15.9	48.6
Aerospace	9,926	10,406	11,736	15,179	12.8	29.3
Fabricated metals	588	698	774	1,062	10.8	37.2
Instruments	2,270	2,843	3,300	4,829	16.1	46.3
Stone, clay & glass	401	459	522	681	13.7	30.3
Chemicals	4,608	5,607	6,663	9,322	19.3	39.9
Paper & pulp	508	584	654	892	11.8	36.4
Rubber	646	687	767	1,055	11.6	37.5
Petroleum	1.565	2,068	2,424	2,895	17.3	19.5
Food & beverage	517	646	718	921	12.5	28.4
Textile mill products/apparel	102	119	132	183	11.5	38.2
Other manufacturing	730	932	1,111	1,448	19.1	30.3
All manufacturing	42,310	49,218	57,816	79,378	17.5	37.3
All nonmanufacturing	1,569	1,814	1,927	2,553	6.2	32.5
All industries	43,879	51,032	59,743	81,931	17.1	37.1

* National Science Foundation data

Source: McGraw-Hill

R&D SPENDING BY INDIVIDUAL PAPER COMPANIES

	1981 R&D spending	% change	1981 R&D expenditures	
Company	**(millions of $)**	**1980-81**	**(as % of sales)**	**(per employee)**
Bemis*	$ 11,500	− 4.1%	1.6%	$1,321
Boise Cascade	5,509	10.0	0.2	186
Consolidated*	3,800	12.9	0.7	727
Crown Zellerbach*	11,700	− 7.1	0.4	412
Fort Howard*	1,800	23.9	0.4	468
Hammermill*	3,600	44.0	0.3	281
James River	5,045	n.a.	0.9	n.a.
Kimberly-Clark	38,400	21.9	1.3	1,223
Longview	479	69.3	0.1	143
Masonite*	7,000	17.3	1.3	969
Mead	37,000	19.4	1.3	1,555
Rexham*	2,000	− 5.2	1.1	734
St. Regis	12,008	17.6	0.4	432
Scott	31,400	0.6	1.4	1,544
Sorg*	1,200	35.4	1.4	2,007
Union Camp*	18,000	11.5	1.1	1,201
Wausau	288	10.1	0.1	128
Westvaco	16,677	17.3	1.1	1,109
Weyerhaeuser	54,322	4.1	1.2	1,269
Industry	261,668	15.3	0.8	915

* Source: McGraw-Hill

Source: 10-K statements, annual reports

ENVIRONMENTAL SPENDING AND REGULATIONS

As a result of environmental legislation passed in the 1970s, the U.S. pulp and paper industry embarked on a massive cleanup program. Environmental outlays claimed more than 20% of total paper industry capital spending in the early 1970s (with the percentage running to more than 30% for primary mills). Total dollar outlays by the paper industry peaked in 1976 as deadlines under major air and water legislation were reached, and in recent years pollution control spending has run about 5% to 7% of total industry capital expenditures.

National Council of the Paper Industry for Air & Stream Improvement Inc. (NCASI) estimates that total outlays by primary mills for air, water and solid waste through 1980 have amounted to more than $5 billion dollars, up from an estimated $700 million spent by the industry for environmental improvement through 1969. Of this, $2.6 billion has been spent on water quality, $2.2 billion on air quality and $200,000 on solid waste disposal.

U.S. PAPER INDUSTRY SPENDING FOR POLLUTION ABATEMENT EQUIPMENT

(millions of $)

	Air	Water	Solid waste	Total	% of total capital spending
1982e	$250	170	60	400	7.1%
1981	160	120	110	380	5.7
1980	160	160	70	390	5.7
1979	133	124	40	297	6.1
1978	105	103	31	239	7.1
1977	188	256	23	468	13.8
1976	182	304	25	511	14.7
1975	273	189	27	489	16.8
1974	308	158	25	491	19.3
1973	174	181	14	369	19.5

e = estimated

Source: Dept. of Commerce

Current spending. The U.S. paper and allied products industry plans to spend $480 million on pollution abatement in 1982, up a hefty 26% over 1981 spending of $380 million, according to a Dept. of Commerce survey conducted in November-December 1981. The industry's pollution control spending will account for 7% of its total capital spending.

The largest share of planned spending by the pulp and paper industry will be used for air pollution control—$250 million, or roughly 52% of total environmental spending. Air-quality protection spending reflects a continuing effort to boost kraft recovery furnace capacity and add-on control technology to reduce sulfur emissions, as well as costs for high-efficiency particulate collection equipment on power boilers and process equipment. Reduced sulfur emission guidelines for existing kraft mills during 1984 and 1985 and efforts to reduce reliance on oil as a fuel source by substituting wood residues or coal will add to ongoing expenditures for air-quality emission control.

Water pollution spending for the control, treatment, and disposal of liquid effluents will take $170 million in 1982, or 35%. Solid waste control will take $60 million, or 13%. Expenditures in the latter category by the pulp and paper industry will include spending for solid waste disposal resulting from waste treatment and on-site manufactuirng operations: spending for trucks, land used for disposal operations, incinerators, etc. With more rigid solid waste disposal regulations now put in place by the Environmental Protection Agency, spending can be expected to continue rising.

U.S. business as a whole plans to spend $9.4 billion for pollution control in 1982, or 2.7% of its total capital budget, compared with $8.9 billion, or 2.8%, in 1981. Industries planning the largest allocations are iron and steel, 13%; nonferrous metals, 9%; electric utilities, 8%; paper, 7%; and chemicals and petroleum, 6% each. Of industries expecting to spend over $200 million in 1982, the largest increases are planned by electrical machinery and mining, 33% each; paper, 26%; nonferrous metals, 13%; and chemicals, 10%. The two industries that spend the most for antipollution plant and equipment—electric utilities and petroleum—plan decreases of 3% and 2%, respectively. Most other industries plan increases.

An upward trend in environmental spending by the pulp and paper industry beyond 1982 is emerging, according to NCASI. Planned increases reflect upcoming water-quality protection regulations calling for major expenditures for controls to be in place by 1984 (although it appears delayed promulgation of these regulations for the paper industry may push deadlines to 1986 or beyond); imposing solid waste disposal regulations taking form; and increasing emphasis on volatile organic emission control and universal requirements for reduced sulfur emission control at existing kraft mills.

UPCOMING LEGISLATION

The U.S. pulp and paper industry in 1982-83 will be affected by developments in environmental regulation on three fronts:

(1) Congressional review of the Clean Air Act under the act's ongoing reauthorization procedure, whereby industry could benefit from efforts in the House and Senate to both streamline the act and simplify industry's technology and permitting requirements;

(2) Upcoming amendments to the Clean Water Act during its 1982 reauthorization, including possible postponements in industry's 1984 compliance deadlines under the current act, and pending regulation by the Environmental Protection Agency governing "best conventional technology" (BCT) requirements for control of conventional pollutants discharged from pulp and paper mills; and

(3) Congressional amendment of the Resource Conservation & Recovery Act (RCRA) during reauthorization, which could broaden the scope of hazardous waste regulation, and upcoming regulations by EPA governing land disposal of hazardous waste and financial responsibilities for storage and disposal facilities.

CLEAN AIR AMENDMENTS

While the paper industry as well as the Reagan administration hoped to pass legislation in 1982 to amend the Clean Air Act, the process will likely extend into 1983 due to the difficulty of reaching a compromise between differing House and Senate versions of a bill and the likelihood of congressional postponement of action on the act due to the November 1982 elections.

Major revisions of the act the paper industry would like to see include modification of the "prevention of significant deterioration (PSD) program, which classifies areas that have attained national clean air standards into Class I, II, or III areas, depending on their degree of "clean air," and permits increments of pollution accordingly; abandonment of stringent lowest achievable emission rate (LAER) standards in nonattainment, or "dirty air," areas where national ambient air quality standards (NAAQS) have not been met; and making uniform technology control requirements which equate best available control technology (BACT) to new source performance standards (NSPS) where they exist.

The House version of a Clean Air bill, HR 5252, sponsored by Rep. Thomas A. Luken (D-Ohio), was issued piecemeal in the winter and spring of 1982. It won immediate backing of the Reagan administration and the paper and forest products industries since it addressed the above three issues, and essentially streamlined permitting procedures for new facilities. However, in May 1982, a controversial amendment to the PSD provision was added to HR 5252 which would restore the act's mandatory Class II areas—whereas the original language in HR 5252 would have dispensed with all Class II designations. Industry backing of the bill collapsed and the bill stalled in committee.

The Senate, meanwhile, moving more slowly than the House under the direction of Sen. Robert T. Stafford (R-Vt.), chairman of the Environment & Public Works Committee, proposed several changes to the law in spring 1982 which addressed acid precipitation control programs, interstate transport of pollutants, hazardous air pollutants, extension of deadlines to December 1985 for attainment of national standards for sulfur dioxide, particulate, and nitrogen dioxide, and streamlining state permittng procedures under the state implementation plan (SIP) process.

In March 1982, Stafford's committee offered a package of amendments which could potentially expand Class I areas and mandate long-term air-quality goals for large facilities emitting over 1000 tpy of any air pollutant. The amendments also would require case-by-case determination of BACT for new facilities emitting large amounts of particulate and other pollutants regulated under the act. In April and May the committee adopted a package of nonattainment amendments which would replace the LAER technology requirement with BACT, and would waive the emission-offset requirement for facilities that would not comprise more the 1% of total emissions in a nonattainment area.

Thus, the clean air legislation that was emerging in mid-1982, judging by the areas of agreement between the House and Senate, will likely contain the following specific provisions:

- In attainment areas, no changes will be made to the PSD increment system in Class I areas, in fact, more areas may be studied to warrant such classification. States will likely have more say in determining Class I areas.
- In Class II areas, where most paper mills are located, the increment system of pollution allowance will not be eliminated, as paper industry lobbyists would prefer, but may have the daily increment allowance

replaced with a yearly allowance.

- Attainment deadlines for states to achieve national air-quality levels, currently targeted for December 1982, will likely be extended to the mid- to late-1980s.
- Case-by-case determination of BACT will likely be required for new facilities emitting 500 tpy or more of air pollutants in both attainment and nonattainment areas of the country. It is also likely that BACT will be equated to NSPS for sources under the 500-tpy threshold.
- In nonattainment areas, LAER standards may be replaced by industry-supported BACT standards, thus simplifying control-technology requirements and giving states more flexibility to consider cost, energy, and other factors in establishing control requirements.
- The visibility protection program will apply only when there is "significant" impairment rather than "any" impairment as in the current law.
- Acid precipitation research will be accelerated.

CLEAN WATER ACT PROPOSALS

Debate in Congress over proposed amendments to the Clean Water Act will be far simpler, as far as the paper industry is concerned. The act is up for reauthorization in 1982—although action is likely to be postponed to 1983 after Congress acts on clean air legislation—and congressional action will focus on pretreatment standards for pulp and paper mills discharging into publicly owned treatment works (POTWs); extension of best available technology (BAT) standards for toxic pollutants and best conventional technology (BCT) standards for conventional pollutants; and national pollutant discharge elimination system (NPDES) permits.

The Environmental Protection Agency in April 1982 developed the administration's Clean Water Act draft bill containing 14 amendments, many of which are acceptable to the paper industry. Among its provisions, the bill would:

- Extend the deadline for promulgating BAT requirements to July 1, 1984, and push back industry's compliance deadlines from 1984 to 1988;
- Allow EPA and states to impose processing fees for waivers and exemptions under the act;
- Require general pretreatment program requirements by July 1, 1984 similar to those now already in effect but not mandated by the act;
- Apply stringent new source performance standards to facilities built after final regulations are published;
- Authorize EPA to assess civil penalties of up to $5000/day for violations of the act, and $50,000/day and jail terms for dischargers who "knowingly" violate the act;
- Make most dams nonpoint sources of pollution under state control and thus not subject them to NPDES permit requirements; and
- Extend the term of NPDES permits from five to ten years.

Key Senate and House committee members support several of the proposals offered by the administration,

ENVIRONMENTAL LEGISLATION AFFECTING THE PULP AND PAPER INDUSTRY SINCE 1970

1970

Air Quality Standards Act
(Clean Air Act)
(P.L. 91-604)

Water Quality Improvement Act
(P.L. 91-224)

Resource Recovery Act
(P.L. 91-512)

Occupational Safety & Health Act
(P.L. 91-596)

1972

Water Pollution Control Act Amendments
(P.L. 92-500)

Environmental Pesticide Control Act
(P.L. 92-516)

1973

Clean Air Act Amendments
(P.L. 93-15)

1974

Safe Drinking Water Act
(P.L. 93-523)

Clean Air Act Amendments
(P.L. 93-319)

1976

Toxic Substances Control Act
(P.L. 94-469)

Resource Conservation & Recovery Act
(P.L. 94-580)

1977

Clean Air Act Amendments
(P.L. 95-95)

Clean Water Act Amendments
(P.L. 95-217)

1978

Resource Conservation & Recovery Act Amendments
(P.L. 95-509)

1980

Solid Waste Disposal Act
(P.L. 96-482)

Comprehensive Response, Compensation & Liability Act (Superfund)
(P.L. 96-510)

and the Clean Water Act legislation is expected to include deadline extensions for BAT and BCT compliance, extension of NPDES permit periods, and a simplification of the pretreatment program, with more control offered to municipalities.

On the regulatory front, EPA has yet to issue specific BCT requirements for the paper industry. Originally proposed in December 1980, EPA's BCT guidelines for the paper industry were invalidated by a federal appeals court on the grounds that the agency failed to use a cost-effectiveness test for effluent control and that statistical and methodological errors had been made in the agency's test methods. New EPA guideline proposals are due in 1982.

SOLID WASTE RULES

The Resource Conservation & Recovery Act of 1976 and subsequent amendments to the law in 1980 direct EPA to develop and implement a program for treatment, storage, transportation, and disposal of hazardous waste. Reauthorization of the act by Congress was due by Sept. 30, 1982.

The pulp and paper industry, whose waste streams are relatively innocuous, has for the most part easily complied with RCRA's standards. The industry has developed storage facilities for materials such as waste solvents, and has had to comply with the manifesting requirements for transportation of some wastes that are shipped for treatment or disposal.

While the paper industry generally supported reauthorization of RCRA without substantial change, amendments to the act proposed by the House's Energy & Commerce Committee in the spring of 1982 triggered reaction by the industry to the threat of several changes in the law. One amendment would permit unlimited litigation even though a facility is in compliance with the law. Another would require that a new permit be issued if a facility expands more than 10%. And another amendment would do away with the 1 ton/month small generator exclusion and substitute a 225 lb/month cutoff. Many paper industry facilities previously exempt would be covered by this change.

The direction these proposed amendments will take is not yet known. EPA's Assistant Administrator for Solid Waste, Rita M. Lavelle, claims that the agency feels the amendments were not necessary and testified before the House committee to that effect.

On the regulatory front, EPA has been studying the concept of regulating hazardous waste by assessing the degree-of-hazard of the material. Present regulations set up a pass-fail scheme whereby waste either is or is not hazardous, resulting in many wastes being caught by the system that show only one minor characteristic, such as a low pH, as being hazardous. The degree-of-hazard approach could provide a means by which marginally hazardous wastes would be handled in a less restrictive manner, and thus, disposal of waste lime—which can exhibit a high pH—would not have to meet stringent requirements imposed by other manufacturing wastes. The paper industry supports EPA's efforts in this direction.

PAPER MACHINERY

The U.S. pulp and paper industry may be expanding in overseas markets, but an increasing amount of its output is being produced on machinery made by foreign suppliers.

This trend was confirmed by a study recently conducted for the Pulp & Paper Machinery Manufacturers' Assn., which has been trying to find out the cause for an eight-year decline in its members' domestic market share, culminating in the industry's first trade deficits in 1978-79.

Shipments by the more than 50 U.S. companies that manufacture pulp and paper machinery have increased in value from $724 million in 1974 to $1.21 billion in 1979, according to the latest available data from the U.S. Bureau of Census. But U.S. imports of paper machinery from foreign manufacturers rose at an even faster pace, from $90 million in 1974 to $254 million in 1980—a nearly threefold increase, according to Dept. of Commerce statistics. Exports by U.S. paper machinery manufacturers, meanwhile, increased from $151 million in 1974 to $318 million in 1980.

As a percentage of total U.S. paper machinery industry shipments, foreign imports have risen from 12% in 1974 to around 20% in 1979, according to the study, which was performed for PPMMA by R M Associates of Neenah, Wis., with some assistance from the Commerce Dept. The ratio of U.S. paper machinery exports to imports declined from a 1975 high of 2.44% to a low of 0.94% in 1979 but improved to 1.25% in 1980—returning to a positive trade balance.

Paper machines. The overall trend toward increasing foreign import penetration holds true for paper machines, the biggest ticket item among various categories of paper machinery, with foreign suppliers—mainly from Scandinavia and West Germany—accounting for an increasing number of the new machines started up in the U.S. In 1974-76, for example, of the 32 new machines that went on-line, 29 were supplied by U.S. manufacturers while only three came from Europe. Of 32 new machines also started up in the 1979-81 period, however, only 17 were domestic, while 15 were foreign.

PULP & PAPER MACHINERY INDUSTRY (SIC 3554) SHIPMENTS, EXPORTS AND IMPORTS, 1980-74

(millions of $)

	1980	1979	1978	1976	1974
Shipments	n.a.	1207.6	938.9	869.3	723.8
Exports	318.4	232.6	177.7	191.8	151.4
Imports	253.8	246.4	182.3	109.5	89.8
Ratios					
Imports/total sales	n.a	20.0	19.0	12.0	12.0
Exports/imports	1.25	0.94	0.97	1.75	1.68

Source: U.S. Dept. of Commerce

(The same trend is visible in Canada where 12 new paper machines are being installed between 1981-84. Of these, six are coming from Europe, five are being supplied by U.S. machinery makers or their Canadian subsidiaries, and one is being made by a Canadian firm.)

However, not all types of paper machinery have been equally affected by the rising tide of foreign imports. While nearly all new cut-size sheeters and continuous digesters have been imported, U.S. manufacturers remain dominant both at home and overseas in process control and drive equipment.

To find the reason for the overall decline in market share, the PPMMA study surveyed 43 paper machinery manufacturers and 29 pulp and paper companies (including one Canadian and six European firms).

Technology lag? While domestic paper machinery manufacturers generally feel their technology is equal to or better than that of foreign suppliers, their customers are somewhat less convinced. Only 16% of the paper companies surveyed said the U.S. was better in technology, while 44% reported equivalence between U.S. and foreign equipment and a significant 40% judged foreign suppliers to be superior in technology. One area where U.S. suppliers were perceived to be significantly behind was in energy-saving machine design.

In meeting delivery dates, about 40% of paper companies interviewed felt that U.S. suppliers were better, while 40% said that U.S. and foreign manufacturers were equal, and 20% believe that U.S. suppliers are worse. (One cause for this less-than-perfect record, PPMMA notes, is the tendency of customers to order paper machinery in spurts, which tends to overload suppliers.) As for technical service, 50% of the paper companies said U.S. suppliers were better, although 47% said that their warranties were worse than those offered by foreign suppliers.

Financing terms. In the area of pricing and financing, domestic manufacturers appeared to be at the greatest disadvantage. Of the paper companies surveyed, only 12% said the U.S. paper companies offfered better purchase financing terms, while 68% said terms offered by foreign suppliers were better. More than half the paper companies said financing terms were "very important" in making their purchasing decisions.

PPMMA noted that in late 1981 U.S. customers had to pay at least 16% to finance equipment bought in the U.S., while U.S. machinery manufacturers can get approximately 10.5% financing from the U.S. Export-Import Bank for their foreign customers, and foreign manufacturers can get roughly 9% financing from their export-import banks to sell machinery in the U.S.

Unequal tariffs. While only 9% of the paper companies said that the package price was "very important" in their purchasing decisions and 54% indicated a willingness to pay a premium for equivalent domestic machinery, PPMMA said that its members felt that price was the major reason why they lost business to foreign competitors.

The association notes that the current U.S. tariff on imported paper machinery is lower than that levied by most countries on U.S.-exported paper machinery and that by 1987 all paper machinery will be allowed into the U.S. duty free. "There is something grossly unfair in allowing pulp and paper machine equipment from a country like Finland to be imported into the U.S. with no duty, while equipment sold from our country is assessed a 5.1% duty when imported by Finland," PPMMA said.

Package pricing. Of the paper companies surveyed, 79% said that package pricing of U.S. machinery was equivalent to that supplied by foreign manufacturers. Nevertheless, PPMMA maintains some foreign manufacturers have been selling at "significantly lower prices" in the U.S. to establish market share and are able to do this either by accepting lower profits on U.S. sales or because they receive government subsidies.

"Since 1977, certain members of our association have had reason to believe that certain Finnish com-

CATEGORIES OF PAPER MACHINERY*

Wood preparation machinery Machinery involved from receipt of rough wood at the mill yard to delivery of prepared wood or chips to the pulp mill

Pulp manufacturing machinery All equipment required for processing wood or other raw fiber into pulp for delivery to stock preparation...including chemical recovery equipment

Pulp refining machinery Processing of pulp fiber for delivery to the paper machine(s)

Paper and paperboard manufacturing machinery From the headbox through the machine winder

Finishing machinery Supercalenders, winders, sheeters, and sheet and roll wrapping equipment

Converting machinery Coaters, laminators, embossers, saturators, corrugators and fabricating equipment...boxes, cores, bags, envelopes

* Based on classification scheme proposed by PPMMA for use by the Bureau of Census in collecting statistical information

AD VALOREM TARIFFS CHARGED BY VARIOUS COUNTRIES ON IMPORTS OF PAPER AND BOARD MANUFACTURING MACHINERY

(Brussels Tariff Nomenclature 84-31)

Country	Current	Projected Jan. 1, 1987
United States[1]	2.6%	Duty free
Finland	6.9%	5.1%
West Germany[3]	4.7%	3.8%
United Kingdom[3]	4.7%	3.8%
Canada[2]	13.6%	9.2%
Japan	5.7%	n.a.
Brazil	45.0% + 5% V.A.T.	n.a.

1. TSUS 66800.40.
2. Converting machinery is duty-free
3. Other converting machinery is currently 5.2%

panies were selling substantially below cost, or in effect, dumping the products on the U.S. market," the association said. "In spite of what these members felt was reasonable proof of this, the U.S. government has been unwilling to take any action." Such charges, however, have been disputed by foreign machinery suppliers.

Two-part program. In response to the increasing foreign competition, PPMMA is launching a two-part program designed to improve marketing of U.S. paper machinery and change certain governmental trade policies. As part of the marketing program, the U.S. industry will conduct more foreign trade missions overseas and increase participation in foreign trade shows. In addition, domestic suppliers plan to increase emphasis on new product development (current R&D spending in the industry is about 2.5% of sales).

The governmental relations program will seek more favorable tariffs for U.S. machinery, better U.S. Export-Import Bank financing terms, U.S. government assistance for trade missions and shows, and action against any foreign manufacturers selling in the U.S. below cost in order to establish market share.

U.S. and foreign suppliers. Beloit Corp. is the largest domestic U.S. paper machine supplier, with Black Clawson Co. a distant second. In addition to paper machines, both companies produce a wide range of paper machinery and operate plants in other parts of the world. Dominion Engineering Works Ltd. is a domestic Canadian paper machine manufacturer.

European paper machine suppliers that have been active in the North American market include TVW Paper Machines Inc. which sells paper machines made by Tampella and Valmet of Finland; KMW of Sweden; Escher Wyss Manchester, a joint venture between Escher Wyss of West Germany and Diamond International Corp.; and Voith Inc. of West Germany.

Kamyr Inc. of Sweden is the dominant world supplier of continuous digesters.

Among the largest recovery and power boiler suppliers to the pulp and paper industry are Babcock & Wilcox Co. and Combustion Engineering, both headquartered in U.S.

Leading suppliers of computer process control systems include AccuRay Corp., Measurex Corp. and Foxboro Co., all of the U.S.

MANUFACTURERS BY COUNTRY OF NEW PAPER MACHINES STARTED UP IN U.S., 1974-81

(Number of machines)

Manufacturer	1974	1975	1976	1977	1978	1979	1980	1981-P	Beyond 1981-P	Total
Allis Chalmers (U.S.)	1	—	—	—	—	—	—	—	—	1
Beloit (U.S.)	4	6	4	3	1	6	5	1	8	38
Black Clawson (U.S.)	1	2	1	—	2	—	1	—	1	8
Horne (U.S.)	1	—	—	—	—	—	1	—	—	2
Manchester (U.S.)	2	3	1	—	1	—	—	—	—	7
Sandy Hill (U.S.)	1	2	—	—	1	1	1	1	—	7
Dominion (Canada)	2	—	—	—	—	—	1	—	—	3
Holder (U.K.)	—	—	—	—	1	—	—	—	—	1
KMW (Sweden)	—	—	—	—	2	1	—	2	1	6
Tampella (Finland)	—	1	—	—	2	—	2	2	1	8
Valmet (Finland)	—	—	—	—	—	1	—	1	4	6
Voith (W. Germany)	—	—	—	1	1	3	2	—	—	7
Total U.S.	10	13	6	3	5	7	8	2	9	63
Total foreign	2	1	—	1	6	5	5	5	6	31
% U.S.	80%	93%	100%	75%	45%	58%	62%	29%	60%	67%
% foreign	20	7	—	25	55	42	38	71	40	33

P = projected

Source: PPMMA members, PULP & PAPER

CANADA

INDUSTRY STRUCTURE

About 80 corporate entities manufacture pulp, paper or paperboard in Canada, operating about 120 paper and board mills and 115 pulp mill sites (companies with combined pulp and paper capacity of 1000 tpd or more are listed in the "Major firms" section of Company Profiles). A total of 144 manufacturing establishments were listed by Statistics Canada in 1980 in its annual "Pulp and Paper Mills" survey of the industry.

The largest number of establishments employ between 200 and 499 workers, and 500 and 99 workers (84 total, 42 in each category), with only 25 establishments having 1000 or more workers on-site and the balance having less than 200. The mills with over 1000 workers lead in terms of salaries and wages paid, value of goods manufactured and value added.

PULP, PAPER AND BOARD MILLS IN CANADA

(Number of millsites)*

	Paper/ board mills	Pulp mills
Alberta	3	2
British Columbia	11	26
Manitoba	4	4
New Brunswick	6	10
Newfoundland	3	2
Nova Scotia	5	5
Ontario	35	26
Quebec	51	44
Saskatchewan	—	1
Total	118	120

* Integrated mills producing both pulp and paper are counted twice, once as a pulp and once as a paper mill. Pulp mills producing two or more different types of pulp are counted only once.

Source: Post's Pulp & Paper Directory (1983)

Geographic center of the industry is in Quebec, with 5.6 million metric tons of paper and paperboard produced in 1980 compared with 3.5 million tons in Ontario and 2.2 million tons in British Columbia, with 2.1 million tons in the other provinces. Quebec also led in woodpulp output, with 6.4 million metric tons compared with 5.8 million tons in British Columbia and 4.4 million tons in Ontario, and 4.2 million tons in the other provinces.

Productive capacity is less concentrated in the pulp and paper industry than in many other sectors of the Canadian economy, but the capital-intensive nature of the industry is gradually increasing the level of concentration in many areas of Canadian pulp and paper.

On the other hand, the current explosion of Canadian newsprint capacity, plus conversion of some capacity by some producers to make groundwood specialty papers, has actually reduced concentration in the newsprint industry. In 1982 PULP & PAPER estimated the top 10 Canadian newsprint manufacturers controlled 71% of Canadian capacity—down from 78% in 1980.

The bulk of Canadian production goes into market pulp and newsprint, with those two commodities representing between them 77% of total 1981 pulp, paper and board shipments. Similarly, exports are far more important for the industry than domestic shipments, with exports representing 78% of all shipments in 1981. Pulp and paper exports in 1980 represented 11.4% of all Canadian exports in terms of dollar value, according to Canadian Pulp & Paper Assn., and 11.5% of all Canadian exports to the U.S.

Pulp and paper is the largest Canadian industry in terms of wages and salaries paid, total employment and value added by manufacture, and third in terms of the selling value of factory shipments, according to StatCan. It is 83% larger in value of exports than the second-most-important export industry, passenger cars, and the woodpulp export business alone would rank fourth in the nation among export commodities.

The importance of the industry to the Canadian economy in general and to Canadian exports in particular has fallen over the last 30 years, however. StatCan figures show that the 11.4% share of total exports claimed by pulp and paper mills in 1980 was down from 21.3% in 1952. Pulp and paper represented 3.9% of the Canadian gross national product in 1980, down from 5.0% in 1952.

Pulp and paper workers in Canada earned an average of C$437.79/week in 1980, the highest of any major industry, followed by smelting and refining workers who made just under C$418/week.

LEADING CANADIAN FIRMS

(1981 reported sales over C$200,000,000)

Company	**1981 sales**	**Paper/board capacity (rank)**	**(m tpd)**	**Pulp capacity (rank)**	**(m tpd)**
MacMillan Bloedel	C$2,230,100,000	3	4602	3	5932
CIP Inc.[1]	n.a.	2	4645	2	6256
Domtar	1,764,700,000	5	3698	5	3660
Abitibi-Price	1,763,385,000	1	7333	1	8068
Consolidated-Bathurst	1,491,303,000	4	3985	4	4746
Noranda[2]	1,474,000,000	13	430	11	1161
B.C. Forest Products	815,000,000	7	1574	7	2720
Great Lakes Forest Products	568,594,000	9	1345	6	3020
Ontario Paper	368,000,000	6	2300	8	2505
Fraser Paper	422,172,000	8	1461	12	1133
Eddy Forest Products	421,618,000	12	902	13	650
Irving Forest Products[1]	n.a.	11	1085	9	1847
Donohue	289,882,000	10	1090	10	1617

1. Included due to large capacity tonnage
2. Sales of forest products group only, not corporate total

Source: Compiled from data in Company Profiles section

TEN LEADING CANADIAN MANUFACTURING INDUSTRIES, 1978*

	Number of employees	**Wages, salaries (C$000)**	**Selling value of shipments (C$000)**
Pulp & paper	85,601	1,696,769	7,648,960
Sawmills and planing mills	66,457	1,098,329	4,693,644
Misc. machery/equipment	63,692	961,458	3,409,200
Iron & steel mills	56,669	1,041,367	4,959,618
Motor vehicle parts, accessories	56,600	1,005,243	4,691,976
Motor vehicles	51,103	996,277	10,070,136
Slaughter/meat processing	34,812	519,781	5,515,355
Smelting & refining	32,652	602,191	2,371,300
Dairy products	26,972	381,426	3,399,837
Petroleum refiners	19,670	439,654	10,354,049

*Latest available

Source: Statistics Canada

PRODUCTION, EXPORTS/IMPORTS

Canadian mills manufactured more paper and paperboard in 1981 than ever before, boosting total output 1.1% from 1980, to 13.5 million metric tons. But as mid-1982 approached and a deep worldwide recession continued unabated, Canada's mills were producing at the slowest pace since 1978—the rate for the first five months was 3.1% slower than that of the same period of 1981. That suggests an annual rate for 1982 of only about 13.1 million tons, below the 13.4 million tons of 1978, though still above 1977's 12.1-million-ton performance.

The industry's output in 1982 could end up lower than midyear trends would suggest, however, since newsprint production—inflated by inventory-building in anticipation of an eastern strike that never materialized—was expected to drop substantially in the second half.

Woodpulp output had already begun to suffer the year before from economic stagnation, dropping in 1981 by 3.4% from 1980's record 19.97-million-metric-ton level, to 19.3 million tons. Then in the early part of 1982 that decline steepened, with production through May falling off by 7.3% from the year-earlier pace. That suggests an annual rate below 17.9 million tons, which would be the lowest since 1976 at best—and possibly the lowest since 1975, the trough of the worst postwar recession to date, when production dropped to 15.1 million tons.

Market pulp shipments were in even worse shape, apparently headed for a 10% drop in 1982 from 1981's 7.3-million-ton-level—which was already off by 7.6% from 1980.

Worldwide slump hurts pulp mills. Canada's pulp mills produced 16% of all the pulp manufactured in the world in 1979, and approximately a third of Canadian output is exported to serve world pulp markets. In 1981, 34.1% of all Canadian pulp production was exported. But through the first five months of 1982, that percentage had fallen to 31.8%, while the country's chemical paper-grade pulp mills ran at only 83% of capacity—compared with a 92% operating rate for the same period of 1981.

The reason for the sickness in Canada's pulp industry, clearly, was the decline in export demand. Domestic consumption of pulp represented only 10.1% of total production in 1981, and while domestic shipments in the first five months of 1982 were off by 12.7%, the far larger export segment plummeted 17.3%. Shipments to the U.S. slid down 15.7%, while the smaller European and Latin American segments dropped by 17.8% and 51% respectively. Shipments to Japan, another important trading partner for Canada's pulp industry, had fallen 14.9% through May.

Caused by a simultaneous worldwide recession that dampened demand for paper—and hence pulp—all over the world, the shrinkage in Canada's export trade in pulp led to a collapse in market pulp pricing that began to echo the chaos of the mid-1970s. The price cycle of the early 1980s saw list prices for Canadian bleached

CANADIAN DOLLAR VALUE IN U.S. DOLLARS

(average for year)

Year	C$ = U.S.$	Year	C$ = U.S.$
1972	1.000	1978	0.877
1973	1.000	1979	0.854
1974	1.022	1980	0.857
1975	0.983	1981	0.835
1976	1.014	1982	0.769*
1977	0.940		

* June 1982 low. Between January and September was between 84 cents and 77 cents, averaging just over 80 cents for the first eight months of the year.

Source: PULP & PAPER

softwood kraft pulp, delivered in northern Europe, peak at $545/metric ton in 1980 and 1981, fall to $500 in mid-1982, and still were heading downward—with actual transaction prices lower yet.

Downtime becomes widespread. As a result, most of Canada's market pulp industry began taking extensive downtime as the summer months began, lasting over a month in some cases. Canadian paper-grade market pulp mill inventories had reached 728,000 metric tons in June 1982, up 86,000 tons from a month earlier. Most observers expected planned summer shutdowns to trim those stocks to more manageable levels, but the long-term recovery of Canada's market pulp industry was clearly dependent on a rebound in paper demand in the U.S. and Western Europe.

The weakness on total pulp shipments was spread across the board, affecting all grades of pulp. Through May, dissolving and special alpha pulp shipments fell 23.9%; bleached sulfate softwood dropped 13.8%; semibleached sulfate tumbled by 34.4% and bleached sulfite declined by 24.6%. All of these grades had also dropped in 1981 from healthy 1980 levels, and in some cases had declined in 1980 from 1979 shipments.

Newsprint heads for downturn. Newsprint mills in Canada produced at an artificially high—although by no means record—level in early 1982, as publishers accumulated inventory out of fear of a possible eastern Canadian strike in the spring. Then, when mills settled

CANADIAN WOODPULP PRODUCTION AND SHIPMENTS BY MAJOR GRADES, 1979-81

(000 metric tons)

	1st half 1982	% change year ago	1981	1980	1979
WOODPULP PRODUCTION					
Bleached sulfite	156	−28.8%	418	405	407
Unbleached sulfite	805	−12.5	1,819	1,763	1,833
Total sulfite	961	−11.8	2,237	2,168	2,240
Bleached softwood sulfate	2,815	− 6.4	5,444	5,922	5,559
Bleached hardwood sulfate	427	+11.5	812	832	818
Semibleached sulfate	506	−12.6	1,057	1,182	1,104
Total bl & semibl sulfate	3,748	− 5.6	7,313	7,936	7,481
Total white pulps	4,709	− 7.8	9,550	10,104	9,721
Unbleached sulfate	626	−22.0	1,497	1,688	1,690
Total chem paper-grade	5,335	− 9.8	11,047	11,792	11,411
Semichemical	140	−17.2	323	333	323
Mechanical	3,647	− 4.5	7,631	7,706	7,388
Screenings	9	−10.0	19	26	26
Total paper-grade	9,131	− 7.8	19,020	19,657	19,418
Dissolving, special alpha	115	−23.8	274	311	368
Total woodpulp	**9,247**	**− 8.1**	**19,294**	**19,970**	**19,516**
MARKET PULP SHIPMENTS					
Bleached sulfite	146	−28.8	376	392	406
Unbleached sulfite	36	−36.8	105	122	111
Bleached softwood sulfate	2,331	−16.4	4,982	5,381	5,096
Bleached hardwood sulfate	268	−14.6	602	592	558
Semibleached sulfate	186	−31.6	485	579	531
Unbleached sulfate	96	−21.3	226	232	264
Total chem paper-grade	3,062	−18.5	6,776	7,298	6,966
Mechanical	131	−18.1	284	322	109
Dissolving, special alpha	106	−28.4	270	310	371
Total woodpulp	3,299	−18.8	7,330	7,930	7,446
OPERATING RATES					
Chemical paper-grade	83%	92%[2]	87%	95%	90%

1. Excludes pulp sent to integrated and affiliated mills inside Canada
2. Year-ago operating rate (1st half 1981)

Source: Canadian Pulp & Paper Assn.

their labor difficulties without a walkout, publishers were left with a massive inventory overhang: total consumer stocks at the end of May 1982 were 1.6 million metric tons, equal to 62 days of supply at then-present consumption levels—an increase of almost 300,000 metric tons from the same period of 1981. Clearly, downtime was in order.

And starting at midyear, temporary shutdowns that had already been extensive began to be nearly universal. Canadian mills ran at 89% through June but operated at only 79% in that month and were expected to average close to 70% through the second half of 1982, as demand began to lag year-earlier levels and U.S. mills' increasing capacity began to displace more-distant Canadian capacity.

Canada's newsprint industry enjoyed a record 1981, producing 8.9 million metric tons in that year compared with 8.8 million tons in 1978, the previous record year, and 3.7% more than 1980. But the effects of the more competitive U.S. industry were already being felt, with shipments to the U.S. dropping by 56,000 tons to 6.1 million tons in 1981. Shipments overseas rose 285,000 tons to 1.8 million tons to more than offset falling U.S. demand—a phenomenon that was not to be repeated in 1982, however. Especially hard-hit in the first half of 1982 were shipments to Latin America—off 23.4% through June to 238,100 tons—and to Asia—with first-half shipments down 48.7% to 86,000 tons.

Other grades. Containerboard shipments in the first five months of 1982 followed the same pattern as that of the U.S. containerboard industry, falling sharply with the drop in North American industrial production. Canadian linerboard shipments, which hit a record 1.2 metric million tons in 1980, dropped 8.0% in 1981 to 1.1 million tons, and then in the first five months of 1982 ran 18.8% behind the same period of 1981. Canadian paperboard mills ran at 95% of capacity in 1980, then operated at only 89% in 1981—and saw that rate fall still farther in the first five months of 1982, to 77%.

Groundwood specialty paper ran counter to that trend, rising 2.9% to 631,000 tons in 1981, followed by a 5.4% jump through May 1982 from the rate in the first five months of 1981. Book and writing paper mills were also running ahead of a year earlier through May of 1982, boosting shipments by 15.9%, although the 789,000-ton level that industry reached for all of 1981 was 12.2% lower than a strong 1980 showing.

CANADIAN PAPER AND PAPERBOARD PRODUCTION BY MAJOR GRADES, 1979-81

(000 metric tons)

	1st half 1982	% change year ago	1981	1980	1979
PAPER					
Newsprint	4,346	− 3.6%	8,946	8,625	8,709
Groundwood printing, specialties	331	+ 0.9	645	614	611
Book & writing	414	+12.2	786	895	914
Kraft papers	232	+12.8	490	533	588
Tissue, special papers	202	+ 9.8	388	377	381
Total paper	5,525	− 2.3	11,255	11,045	11,203
PAPERBOARD					
Containerboard	720	−18.4%	1,574	1,671	1,541
Linerboard	460	−21.8	1,087	1,175	1,075
Corrugating medium	260	−11.6	487	496	466
Boxboard	320	−10.9	701	673	742
Total paperboard	1,040	−16.2	2,275	2,344	2,283
TOTAL PAPER & BOARD	6,565	− 4.8	13,530	13,389	13,486
OPERATING RATES					
Newsprint	89%	97%*	94%	94%	97%
Other papers	84	83*	83	88	99
Paperboard	77	94*	89	95	91

* Year-ago operating rates (1st half 1981)

Source: Canadian Pulp & Paper Assn.

TOP CANADIAN PROVINCES IN PULP AND PAPER/PAPERBOARD PRODUCTION, 1980

(000 metric tons)

PULP		PAPER/PAPERBOARD*	
1. Quebec	6411	1. Quebec	5893
2. British Columbia	6032	2. Ontario	3525
3. Ontario	4320	3. British Columbia	2188

* Excludes building board

Source: Canadian Pulp & Paper Assn. estimates

CANADIAN PULP AND PAPER EXPORTS BY MAJOR GRADES, 1979-81

(000 metric tons)

	1st half 1982	% change year ago	1981	1980	1979
WOODPULP					
Bleached sulfite	136	−27.7%	349	355	369
Unbleached sulfite	27	−44.9	93	102	81
Bleached softwood sulfate	2171	−16.4	4616	5049	4791
Bleached hardwood sulfate	172	−15.7	399	381	363
Semibleached sulfate	163	−29.7	407	496	457
Unbleached sulfate	89	−22.6	212	221	256
Mechanical	119	−13.8	257	294	99
Total chemical paper-grade	2753	−18.5	6076	6610	6331
Dissolving, special alpha	101	−28.9	258	291	351
Total woodpulp	2978	−18.7	6591	7195	6782
PAPER/PAPERBOARD					
Newsprint	3644	− 7.7%	7871	7642	7783
Groundwood printing	268	+ 3.1	523	517	486
Book, writing	80	+77.8	127	201	204
Kraft papers	111	− 8.3	207	241	240
Tissue	12	—	25	24	33
Containerboard	180	−26.5	360	458	350
Linerboard	108	−34.5	256	346	254
Corrugating medium	72	− 8.9	103	112	96
Boxboard	16	−20.0	40	38	64
Total paper/paperboard	4311	− 6.8	9153	9121	9160

Source: Canadian Pulp & Paper Assn.

CANADIAN WOODPULP EXPORTS BY DESTINATION, 1979-81

(000 metric tons)

	1st half 1982	% change year ago	1981	1980	1979
United States	1450	−16.9%	3240	3433	3577
United Kingdom	149	−13.9	328	377	408
Other Western Europe	730	−20.7	1673	1794	1606
Latin America	34	−43.3	99	142	86
Japan	362	−11.5	682	885	689
Other countries	253	−29.1	569	564	416
Total	2978	−18.7	6591	7195	6782

Source: Canadian Pulp & Paper Assn.

CANADIAN NEWSPRINT EXPORTS BY DESTINATION, 1979-81

(000 metric tons)

	1st half 1982	% change year ago	1981	1980	1979
United States	2884	− 6.0%	6062	6117	6347
United Kingdom	291	+14.6	541	442	398
Other Western Europe	87	+16.0	189	181	187
Latin America	238	−23.5	625	518	445
Asia	86	−48.8	356	267	247
Other countries	58	+20.8	98	116	159
Total	3644	− 7.1	7871	7641	7783

Source: Canadian Pulp & Paper Assn.

PRICE AND COST TRENDS

PRICE AND THE DOLLAR

Canada's pulp and paper industry exists to serve export markets far more than to serve the domestic market, and the industry's export products are generally priced in U.S. dollars. In recent years this has been a considerable blessing for the industry, since the Canadian dollar has fallen from approximate parity with the U.S. dollar as recently as 1977 to the 77-cent (U.S.) level of mid-1982—bringing with it an unearned windfall profit for exporting companies of as much as 50% to 100% of many companies' profits.

This also means Canadian producers have had a cushion that their U.S. counterparts have not enjoyed when market weakness has prevented price increases—as in the slump of 1982. Indeed, while in 1982 price hike after price hike was being foiled in newsprint and market pulp, Canada's major export commodities—and while U.S. mills could see their own export markets grow less receptive due to the strengthening of the U.S. dollar—Canadian mills were enjoying the short-term benefits of the weakest Canadian dollar in decades.

The long-term benefits of all this for Canadian mills, of course, are not so attractive, since a weak currency also brings with it high domestic inflation and an undermined domestic economy. Indeed, the cost side of the Canadian industry's price-cost equation was considerably less attractive than that facing U.S. producers by 1982. And the lesson should be remembered that a currency differential only provides a particular exporter with a relative advantage—price increases in 1982 were needed by Canadian mills just as they were required by their U.S. competitors.

Not all cost factors rose by the same predictable and regular increments, as a comparison between 1976 cost estimates for British Columbia newsprint mills, made by the Canadian Dept. of Industry, Trade & Commerce, and 1981 cost estimates by Pulp & Paper Week will show. **Energy** costs for British Columbia newsprint mills in 1976 averaged US$24/short ton, according to Ottawa, and by Pulp & Paper Week estimates that had risen to $41 by 1981, a 70.8% rise. But during the same period, **transportation** costs for those mills rose on the average by only 32.3%, to $45/ton, while **labor** costs—including the lower labor intensity of recently installed equipment, plus other labor savings—rose by only 29.4%, to $66/ton.

But by Pulp & Paper Week's estimates, **wood** costs for those mills shot up by 50.8% between 1976 and 1981, reaching $92/ton. And in 1981 wood represented the largest single cost component in producing a ton of newsprint—26.4%, up slightly from the Canadian government's 1976 estimate of 25.6%.

Those dramatic cost increases were roughly duplicated in other sectors of the Canadian industry, as shown by StatCan figures comparing 1976 with 1980 (more recent figures are not available). StatCan figures indicate **pulpwood** costs for the entire Canadian pulp and paper industry rose by 41.9% between 1976 and 1980, and in 1980 represented 28.1% of the total cost of materials and supplies. **Wood residues** represented another 22.2% of the cost of materials and supplies in 1980, having risen by 77.6% from 1976. And **chemicals**, making up 16.2% of the industry's material and supplies budget, grew in cost by 73.1% during the same period.

One restraint on cost increases has been the decreasing **labor** intensity of the industry. Between 1976 and 1980, while shipments of pulp, paper and board were growing by 19.1% according to StatCan/CPPA figures, the number of employees remained virtually unchanged at 87,000 and the number of workhours for production and related workers actually fell by 1.3%. One source estimates that the labor intensity of market pulp mills remained unchanged, at about 3.5 workhours/finished ton of product, while newsprint productivity rose from about 6 workhours/ton to 5. Those trends are expected to continue—and possibly to show up in market pulp also—as technology replaces less efficient machines with more efficient equipment.

Other important cost factors include **repair machinery, equipment** and **construction**, which rose for the entire Canadian pulp and paper industry by 57.2% between 1976 and 1980 according to StatCan/CPPA figures; and **transportation** costs, which vary according to destination but which generally rose by 30% to 40% between 1976 and 1980.

Future cost trends. The near future of costs is impossible to predict, of course, but recent trends would indicate that labor settlements in 1983 and 1984 may be marginally less inflationary than in recent years. If energy prices continue to follow 1982 trends, energy cost increases should show more moderate growth than in the past decade, and if that is the case, energy-related costs such as transportation and chemicals should also moderate. And the most important cost factor—the fiber that keeps the pulp mills running—depends almost entirely on the future of the U.S. and Japanese housing industries, an imponderable that nobody is in a position to predict.

Historically, Canadian prices have not grown as rapidly for those products intended for domestic use as they have for many major export commodities. Between 1976 and 1980, the Statistics Canada price index for fine/writing/reproduction paper rose by 35.5%—very close to the increase in U.S. transaction prices for representative white paper grades—and for corrugating board and linerboard by 46.8%, while the StatCan price index for export newsprint shot up by 69%. Bleached sulfite pulp for export went up 56.4%, and unbleached sulfate for export grew 67%. The index for export bleached sulfate pulp, on the other hand, rose only 47.9%, and market prices have since then fallen.

KEEPING AHEAD OF COSTS

Canadian government figures show that the value of shipments of Canadian pulp, paper and board mills rose by 17.5% in current dollars to C$10.9 billion in 1980 from 1979 levels. In constant dollars the increase was only about 1%, as Canada's wholesale price index rose by 16.2% in 1980. But since the inflation rates in Canada's trading partners were lower than the Canadian rate, that increase in current dollars went straight to the mill's bottom lines, at least for export sales.

Between 1972 and 1978, the value of shipments from Canadian mills shot up by 144.5%, while in the same period the cost of materials and supplies rose by only 119%, according to Statistics Canada. Wages went up by 110.9%, the agency reports. Not all costs rose at a slower rate than the value of shipments, however—the cost of fuel and electricity skyrocketed, shooting up 227%, and spawning a new spirit of energy conservation in the industry (see related chapter).

MAJOR COST FACTORS

Value of shipments rose by another 42.6% between 1978 and 1980, according to StatCan, just barely keeping ahead of the 41.5% climb in materials and supplies but remaining well ahead of the 29.9% growth in electricity and fuel costs and the 18.6% rise in wages.

A variety of measures of mill operating costs exist, including government figures, those worked up for internal use by the Canadian Pulp & Paper Assn., and estimates prepared by consultants and analysts as varied as Sandwell & Co., *PaperTree Economics* and the *Canadian Paper Analyst*. They all disagree about the relative weight to attach to particular cost factors, but they tend to agree on one theme: cost increases in recent years have far outpaced price increases.

One estimate of newsprint cost increases, for example, made by Vancouver analyst Jaak Puusepp of Pemberton Securities, indicates that between 1979 and 1982, costs and expenses (including transportation) for British Columbia mills rose by 61.2%. The largest single reason for this dramatic increase was an 80.9% explosion of **wood costs**, along with a 67.5% rise in **wages**. But while costs were rising by more than 61%, PULP & PAPER WEEK estimates show list prices in the U.S. were going up by only 28.9%. And while list prices were unlikely to rise in 1982, costs were not expected to show similar restraint.

The kind of pressure that puts on pretax profit margins is obvious. Puusepp estimated the margin for the typical British Columbia newsprint mill would fall from 31% in 1979 to 16.8% in 1982—and he was writing before the failure of 1982 price increases became evident.

PRICE INDEXES FOR CANADIAN PULP, PAPER AND PAPERBOARD COMMODITIES

(1971=100)

Commodity	1980	1976	1972
Fine paper (writing & repro., domestic shipments)	219.0	161.6	102.5
Corrugating medium & liner (domestic ship.)	238.5	162.5	103.2
Bleached sulfite pulp (export)	342.1	218.8	97.1
Bleached sulfate pulp (export)	341.0	230.6	93.4
Unbleached sulfate pulp (export)	379.0	226.9	92.3
Newsprint (export)	300.2	177.6	102.8

Source: Statistics Canada

FAILED PRICE INCREASES

In the second quarter of 1980, the price of Canadian bleached softwood kraft pulp exported to northern Europe hit an all-time high of US$545/metric ton, c.i.f. delivered to Europe. Then in the first quarter of 1982, producers attempted to raise the benchmark price by a further $35. Not only did they fail, but a simultaneous worldwide recession soon drove pricing so far backward that by August 1982 list quotes were down to $465—where they had been in the fourth quarter of 1979, and only $30 above the previous peak in early 1975.

At the same time, Canadian mills selling newsprint in the U.S. for US$500/metric ton tried raising their prices $25/ton in March, April and again in June of 1982, and were undermined each time by a sizable group of small and large producers that preferred to undercut the leaders' price hikes and maintain operating rates rather than support an increase and enjoy higher prices. They were still trying for October and November, but were given little chance of success, and some observers felt prices might remain unchanged through most of 1983. Indeed, most spot tonnage was moving $25 to $50 below the list price, although this is not unusual in a soft market.

DOMESTIC PRICING

Times may have been rough for export pricing, but Canadian mills were sometimes more successful at raising prices to their domestic markets. A C$40 price hike in newsprint took effect in early 1982 while the export price increase was failing, although tonnage sold in the U.S. was still as profitable—if not more so—for Canadian mills because of the beneficial effects of the dollar differential.

Canadian mills also enjoy a comfortable dominance of their domestic markets in the whole range of pulp, paper and board products, and that too helps them maintain adequate pricing. Indeed, in 1980, the major imported commodity for the industry was 151,000 metric tons of printing and writing papers, while no other imported commodity exceeded the 50,000 tons of imported building boards.

Thus, at a time (early 1981) when U.S. prices of printing/writing paper were near their cyclical peak, and coated No. 3 printing paper (60 lb in rolls) was going for $897/short ton, Canadian buyers were paying the equivalent of US$1070, by one estimate. Canadian consumers were also paying an estimated US$30/short ton more for their 50-lb multiwall kraft sack than the $405 price in the U.S.

PROFITABILITY

Depressed housing-start levels began cutting Canadian forest products companies' earnings in 1980, but until late 1981 and early 1982, profits from paper and market pulp operations enabled most Canadian firms to run in the black. By the middle of 1982, however, that was no longer true—red ink had become as common as black.

Profits in 1980 for the major Canadian companies dropped 3% below 1979 levels, according to Pulp & Paper Week estimates. Then in 1981, they tumbled another 41%, culminating with the fourth quarter when they plummeted 56% from the same period of 1980. Fine paper and paperboard shipments by Canadian mills and their U.S. affiliates began falling in late 1981.

But despite deteriorating markets, few major companies reported a loss in the fourth quarter of 1981 other than British Columbia Forest Products, Doman Industries, MacMillan Bloedel and Rolland. And of those, BCFP managed to remain in the black for the year as a whole.

But during the first half of 1982, market conditions deteriorated further, and second-quarter earnings for Crown Zellerbach Canada, Fraser Inc. and Weldwood of Canada were also in the red. Of the top companies, only Scott Paper Ltd. reported a rise in earnings—by 2.4%—while profits for the top 10 dropped by a total of 91%.

Slim profit margins. Profit margins fell from 5.4% in the second quarter of 1981 to 0.5% in the same period of 1982. Particularly hard-hit were the western companies, more heavily involved in wood products than the eastern firms, but the damage was widespread even in the almost-pure-paper companies as well. With sales for the top 10 down by 15.2% and falling, it was clear that 1982 as a whole was going to be a financial disaster for the industry.

Market pulp demand weakened in late 1981, hurt by worldwide economic woes that reduced demand for paper, but at about the same time U.S. newspaper publishers began accumulating inventories in anticipation of a mill strike in eastern Canada around mid-1982.

Less help from newsprint. When it became clear such a strike was unlikely, publishers' purchases tumbled, and newsprint mills began taking extensive downtime. Thus, second-quarter 1982 earnings were poor, when they existed at all, and scheduled downtime in newsprint and pulp during the third quarter threatened companies' balance sheets even further.

The one boon for Canadian companies—in the short run, anyway—was the increasing weakness in the Canadian dollar. Valued at over US$0.80 through 1981, the Canadian currency unit gave exporting companies a sizable bonus, since market pulp and newsprint are priced in U.S. dollars. That bonus has been estimated at more than 50% of the industry's net earnings in 1980, and approaching or even exceeding 75% in 1981. In the case of particular companies in 1981, it appeared to range from 50% to 90% or more, and by the second quarter of 1982 it actually exceeded net earnings in several cases, with the Canadian dollar heading down toward US$0.75. In one 1982 study, the *Canadian Paper Analyst* estimated the exchange gain on exports of newsprint at 73% of profit in 1981, heading higher in 1982.

Higher labor costs. But not all the effects of a weak Canadian dollar were positive. The chief financial officer of one Canadian company noted that, "because the Canadian dollar is so weak, basically everything that we incur in costs in Canada is also higher than they would be if the dollar were in a different position. Labor rates in Canada are high vis-a-vis the U.S.; raw materials and chemicals and supplies and services that we buy are also higher than they otherwise would be."

Canada also faced possible wage/price controls intended to get inflation under control and pare interest rates—which, one security analyst noted, would just create a new import-led inflation for that country.

Return to parity. In addition to the problems and benefits of its currency situation, Canada and its industry also face a future worry—the possibility that the Canadian dollar may one day once again move toward parity with the U.S. unit. If that were to happen, many observers believe it would threaten the world position of the industry since it is questionable whether some Canadian companies could maintain their high capital spending budgets if they lost the protection of a weak dollar.

Several companies began entering the market for dollar futures in the early 1980s in order to protect themselves against any future appreciation in the Canadian currency, but since the Canadian dollar is falling in value at this writing, it is too early to say whether these arrangements will benefit those companies.

Rising operating costs. But a more immediate worry in mid-1982 was the rising cost of doing business in face of falling demand for the industry's products. While demand for most products was off, major cost components continued to rise, led by labor. Ross Hay-Roe of PaperTree Economics Ltd. estimated in late 1981 that a 10-point drop in Canadian newsprint mills' operating rates from the then-current level in the mid-to-high 90s would add C$10 to C$15/metric ton to unit manufacturing costs. By June 1982 Canadian newsprint mills were running at 79% of capacity. The operating rate for the second half of 1982 was expected to average as low as 70%. Canada's forest products industry was clearly being buffeted by one of the worst periods in its post-Depression history.

CANADIAN PULP AND PAPER COMPANY SALES AND EARNINGS FOR 1981

(000 Canadian dollars)

	Sales	% change 1980/81	Earnings[1]	% change 1980/81
Abitibi-Price	C$1,763,000	29.2	C$ 124,000	47.6
B.C. Forest	814,900	−4.2	17,200	−71.6
Con-Bathurst	1,479,000	6.5	101,800	−16.8
Crestbrook	94,051	−20.3	2,344	−79.9
CZ Canada	653,100	− 1.3	17,100	−53.0
Doman	115,793	4.7	(10,902)	n.m.
Domtar	1,760,000	6.7	59,400	−38.5
Great Lakes	568,594	5.4	77,774	−4.4
Mac. Bloedel	2,230,100	−9.2	(26,700)	n.m.
Rolland	177,800	5.9	(142)	n.m.
Total	**9,656,338**	**3.7**	**361,874**	**−40.7**

1. Income after taxes, from continuing operations, excluding most significant nonrecurring items in both years.
n.m. = not meaningful.

CAPACITY EXPANSION

After several years of stagnation in newsprint capacity expansion, Canadian companies in the early 1980s once again began to add capacity, as well as to replace outmoded equiment with new, larger, and faster units.

As a result, Canadian paper/paperboard capacity is projected to jump by 11.3% to 17.34 million metric tpy between 1981 and 1984, led by a large rise in newsprint capacity and dramatic growth in groundwood specialties and book and writing paper capacity, according to the annual Canadian Pulp & Paper Assn. capacity survey, released in July 1982.

While paper and paperboard capacity is growing in the double-digit range, pulp capacity is projected to rise by 9.1% to 25.0 million tpy. At the same time, market pulp capacity will go up by just 6.7% to 7.6 million tpy. By contrast, market pulp was projected to grow by 9.1% between 1980 and 1983 in the previous annual survey.

British Columbia continues to be the focus of Canadian capacity expansion, although the growth expected between 1981 and 1984 is marginally slower than that indicated for 1980-83 by the previous survey. Still, with paper and board going up 25.7% to 3.0 million tpy and pulp rising by 14.9% to 7.2 million tpy, the British Columbia growth rate far outstrips other provinces.

Newsprint. The biggest factor in the paper capacity growth rate of both British Columbia and the nation is newsprint. Between 1981 and 1983 it is expected that 1.01 million metric tpy of capacity will be added nationwide, with 470,000 tpy of that coming in British Columbia. Six new machines will come on-line in Canada during that period, adding 525,000 tpy to capacity. Three will be in Ontario, with two in British Columbia and one in Quebec.

In addition, five machines are scheduled to be retrofitted with twin-wire units, adding a further 220,000 tpy of capacity, with the rest of the planned increase coming from machine improvements. During this period, mills in Canada plan to retire 11 machines.

Groundwood specialties. Even more dramatic than the newsprint capacity increase is the scheduled 377,000-ton jump in groundwood printing paper capacity, to 1.04 million tpy. This 57.1% increase is caused by three machine conversions, along with startup of one new unit.

Book/writing, sanitary papers. MacMillan Bloedel and Great Lakes Forest Products have scheduled mill expansions that represent the major share of the planned 11.7% rise in book and writing paper capacity. However, these expansions have been subjected to some delays by problems of the economy in MB's case and a pipefitters' strike in Great Lakes' case. This sector's capacity will rise to 1.14 million tpy, while sanitary paper capacity will go up 14.0% to 490,000 tpy.

Paperboard. Canadian paperboard mills will be adding capacity at a less dramatic rate, with no new machines scheduled. Total containerboard capacity is scheduled to go up only 157,000 tons, or 8.3%, to 2.04 million tpy. Kraft linerboard capacity will go up even more slowly, by 6.8% to 1.04 million tpy, while semichemical corrugating medium will rise 5.9% to 535,000 tpy. Recycled liner and medium represent the fast-growth board sectors, jumping 15.0% to 470,000 tpy.

Total pulp. British Columbia was the site of 27.2% of Canadian pulp capacity in 1981, and by 1984 that will rise to 28.6%. Quebec's share will fall marginally, going from 32.6% to 31.9%, while Ontario's portion will drop from 19.9% to 19.0%. Also falling will be the Prairie provinces, going from 4.7% to 4.5%, while the Atlantic provinces' share will rise slightly, from 15.6% to 16.0%.

Mechanical pulp capacity will shoot up most rapidly, spurred on by expansions in newsprint and groundwood printing paper. Mechanical pulp capacity for paper and board will go up 17.1% to 10.4 million tpy, led by a 109.1% rise in thermomechanical, to 3.6 million tpy.

Market pulp. Integrated mills will claim most of the pulp capacity growth in the 1981-84 period, with market pulp going up only 6.7% to 7.6 million tpy. Only mechanical market pulp will show double-digit growth, going up 63.1% to 517,000 tpy. Sulfite paper-grade market pulp will show little change, as will dissolving and special alpha market pulp—barring the restart of ITT Rayonier's idled Port Cartier, Que., mill.

CANADIAN INDUSTRY ANNUAL CAPACITY GROWTH, 1981-84

(000 metric tons)

	1981	**1982**	**1983**	**1984**
MARKET PULP CAPACITY				
Dissolving & special alpha	303	316	320	324
Sulfite paper grades	397	392	400	413
Sulfate paper grades	6,413	6,418	6,561	6,672
Bleached softwood	5,056	5,081	5,260	5,365
Semibleached softwood	433	424	423	423
Bleached hardwood	634	635	633	659
Unbleached	290	272	245	225
Total chemical paper grades (excl. dissolv. & sp. alpha)	6,810	6,810	6,961	7,085
Increase from previous year	120	—	151	124
	1.8%	–	2.2%	1.8%
Mechanical	317	517	517	517
Total market pulp capacity	7,127	7,327	7,478	7,602
Increase from previous year	197	200	151	124
	2.8%	2.8%	2.1%	1.7%
PAPER & BOARD CAPACITY				
Newsprint	9,490	10,020	10,475	10,500
Groundwood printing	660	751	875	1,037
Book, writing & misc.	1,019	1,039	1,077	1,138
Kraft papers	566	553	558	558
Special papers	37	37	37	37
Sanitary papers	430	459	472	490
Containerboard	1,884	1,918	1,988	2,041
Boxboard	792	796	813	821
Total (excl. bldg. & other)	14,878	15,573	16,295	16,622
Building & other	711	715	720	722
Total paper & board capacity	15,589	16,288	17,015	17,344
Increase from previous year	443	699	727	329
	2.9%	4.5%	4.5%	1.9%

Source: Canadian Pulp & Paper Assn.

CAPITAL SPENDING

Canadian pulp and paper companies planned a large jump in capital spending budgets between 1981 and 1982 when the year began, but over the course of the year virtually every major firm slashed its spending plans under pressure from poor sales and tight money. The rate of increase in the industry's spending intentions may still outpace that of most other Canadian industries, however.

Statistics Canada surveyed Canadian companies in late 1981 and early 1982 and found that the paper and allied industries planned to spend C$2.50 billion on capital projects, excluding repair expenditures, in 1982—a 16.7% increase from 1981's $2.14 billion, which in turn was a 62.1% jump from 1980. In addition, Canadian companies planned to spend another $1.05 billion in 1982 for noncapitalized repairs, up 13.2% from 1981.

By contrast, all manufacturing industries planned to increase their expenditures 11.5% in 1982 to C$13.86 billion.

Cut spending plans. However, a PULP & PAPER WEEK survey in June 1982 showed that every major Canadian company except Consolidated-Bathurst was actually planning to spend significantly less in 1982 than they had in 1981—and in many cases less than in 1980. Con-Bath's spending plans remained unchanged at C$240 million for the two years, up sharply from 1980, but other major companies surveyed planned year-to-year reductions ranging from 10.3% in Abitibi-Price's case to 60.2% in the case of Ontario Paper.

In January 1982 PULP & PAPER indicated that reported expenditures for the 1981-83 period for production would total C$3.949 billion, with water pollution control expenditures adding another $438 million and air pollution control another $365 million, for a three-year total of $4.752 billion. Average annual expenditures were estimated at $3 billion.

Pulping tops spending list. Another PULP & PAPER estimate, including C$814 million in projects already announced for the 1984-86 period plus $4.752 billion in the 1981-83 period, shows the following percentage breakdown between various types of spending: pulping and fiber, 35.9%; new machines, 10.2%; machine modifications, 7.9%; energy and power, 10.5%; plant and miscellaneous, 21.0%; water quality, 7.3%; air quality, 6.6%; solid waste, 0.6%.

As in recent years, British Columbia mills should lead in capital expenditures, with C$1.7 billion of the $5.566 billion in projects so far announced for 1981-86. Ontario is second, with just under $1.57 billion in spending plans, followed by Quebec, with $1.18 billion in spending commitments.

Pulp and paper manufacturing is clearly a capital-intensive industry. Statistics Canada estimates that capital employed per employee rose to C$248,542 in 1980, from $80,881 in 1970. A grand total of $21.3 billion was invested in pulp and paper companies in 1980, up from $6.5 billion a decade earlier.

CANADIAN PAPER COMPANIES' 1982 CAPITAL SPENDING PLANS

(C$ million)

Company	1982	1981	1980	% change 1982/81
Abitibi-Price	C$175	C$195	C$217	−10.3%
B.C. Forest Products	103	220	277	−53.2
Con-Bathurst	240	240	143	—
Donohue	78	125	41	−26.9
Eddy Paper	120	84	n.a.	+42.9
Fraser Paper	59	117	n.a.	−49.6
MacMillan Bloedel	240	308	338	−22.1
Ontario Paper	66	166	n.a.	−60.2

Source: PULP & PAPER WEEK

MERGERS AND ACQUISITIONS

Few major Canadian pulp and paper companies escaped untouched by a rising crescendo of mergers and takeovers that peaked in 1981 before subsiding in the face of high interest rates and tight money. Before the acquisition craze had ended, the face of Canada's largest industry was changed—and control of the country's assets was placed in Canadian hands more firmly than ever before.

Early stages in what McLeod Young Weir Ltd. analyst James Robb called "the asset grab and takeover frenzy" included the purchase of ITT Rayonier's British Columbia assets by three British Columbian firms in 1980, and the substantial withdrawal of Reed International Ltd. from Canada in 1978-79. Abitibi Paper bought Price in 1978, and Noranda Mines purchased Maclaren Power & Paper in 1979.

But that was fairly conventional business activity. What followed in the next two years was a spate of takeovers and takeover rumors without precedent in the Canadian forest products industry. At one point in 1981, nearly every major company in the industry was either on the block or was rumored to be up for sale. Many of the rumors never materialized, but enough did come to fruition to seriously overburden more than one ambitious paper company with debt.

'Merger madness' recedes. Some companies went into the acquisition game to position themselves for international competition, while in other cases, assets such as timber cutting rights and specific pulp and paper mills were the object. In other cases, personal ambition on the part of corporate executives may have been a factor. Canada's forest products industry was not alone in this "merger madness" either, and by early 1982 Canadian banks had lent enough money to various industries for the relatively unproductive purpose of acquiring competitors that the government was forced to step in and instruct bankers to reduce their exposure to individual borrowers.

One result of that tightening of credit was that companies that might have wanted to sell assets for legitimate business reasons—such as the desire of Crown Zellerbach to get rid of its Canadian assets in order to concentrate investment in four core U.S. mills, and ITT Rayonier's wish to unload an idled dissolving pulp mill in Port Cartier, Que.—were unable to find buyers. It was widely expected that takeovers in the Canadian pulp and paper industry would be relatively scarce during 1982, with a change in that situation not likely until Canada's economic troubles abate—something few experts think will happen before mid-1983 at the earliest.

Noranda takes over MB. Some of the traditional players were involved in the takeover binge of the late 1970s and early 1980s. MacMillan Bloedel Ltd., which bought Rothesay Paper in 1969, turned around and sold it to the Irving family interests in 1981. In 1978, MB and Domtar made bids to acquire each other, and Canadian Pacific Investments also made gestures toward acquiring MB but was blocked by the provincial government of British Columbia. In 1980 British Columbia Resource Investment Corp., which already owned Canadian Cellulose, purchased 20% of MB—and then, in 1981, went for control of MB before losing out to Noranda Mines.

Just before the takeover fight between Noranda and BCRIC for control of MB began, MB had reportedly eyed a possible takeover of Abitibi-Price. Abitibi was eventually acquired in 1981 by the Reichmann family following a bruising three-way battle in which Federal Commerce & Navigation Ltd. vied with the Reichmanns and a joint venture composed of Thomson Newspapers Ltd. and Nu-West Group Ltd. for control of Abitibi, with Brascan Ltd. reportedly also waiting in the wings.

Brascan finally got its chance to buy a paper company in 1981 when—in a partnership with the Caisse de Depot et Placement du Quebec—it gained control of Noranda, a holding company with control of Maclaren, Fraser Paper and MB, and a half-interest, with Mead Paper, in Northwood.

Ill-advised deal. Canadian Pacific also got a chance to up its stake in the paper industry—which already included Great Lakes Forest Products—when it bought Canadian International Paper from International Paper for C$1.1 billion in late 1981—in a deal that one analyst said "might rank as one of the most ill-advised in the history of the Canadian forest products industry." Long a cash cow for IP, the CIP unit immediately began to record poor financial performance for CP, and will clearly need major capital investment in the coming years.

The other major acquisition that has been widely criticized is the purchase of ITT Rayonier's British Columbia assets by British Columbia Forest Products, Doman Industries and Whonnock, creating a new company called Western Forest Products. Almost from the first, WFP was too heavily burdened with debt resulting from the purchase—as were its three owners—to execute the kind of capital program needed to make its pulp mills competitive. In the case of Doman and Whonnock, the resulting debt was enough to place those companies' future growth in doubt, and Doman at least was widely believed to be up for a possible reorganization at the behest of its banks, due to its overwhelmingly unfavorable debt-equity ratio.

Quebec's Caisse. Consolidated-Bathurst concentrated throughout this merger mania on building its own assets, although at one time in 1981 it was rumored that 40%-owner Power Corp. might sell its Con-Bath stake to gain control of Canadian Pacific Ltd. Power Corp. bought 4.4% of CP Ltd. in 1981. At the same time, two Quebec government agencies—the Caisse de Dépot et Placement du Québec, and the Société Generale de Financement du Québec—were gaining effective control over Domtar. The Caisse has also gained an 18.9% interest in Rolland Inc., in addition to its interests in Noranda and CP Ltd.

A complete list of mergers, takeovers and intercompany investments in Canada would be much longer, but three conclusions would emerge from any such list: that the financial crunch of 1982 largely put a stop to such activity; that the takeover binge increased Canadian ownership of Canadian assets; and that the new Canadian owners were thus put in a position to share in the losses that the Canadian forest products industry was suffering in the recession year of 1982.

MAJOR CANADIAN PAPER INDUSTRY ACQUISITIONS

Acquiring company	Paper company acquired	Estimated value (C$ million)	Year
Olympia & York	Abitibi-Price	C$ 530	1981
Canadian Pacific	CIP Inc.	1,100	1981
Noranda Mines	MacMillan Bloedel (49% interest)	626	1981
Brascade Resources	Noranda Mines (39% interest)	1,100	1981
Irving Pulp & Paper	MacMillan Rothesay	145	1981
Caisse de Depot & Societe Generale	Domtar (42% interest collectively, from 25% held by Caisse only)	n.a.	1981
Power Corp.	Canadian Pacific Ltd. (5.0% interest, up from .6%)	n.a.	1981
Alberta Energy	B.C. Forest Products (28% interest, from Noranda	215	1981
Fraser Inc.	Abitibi-Price's Thorold, Ont. fine paper mill	n.a.	1981
Belkin Packaging	Continental Group mill in Montreal & mill in Toronto	60	1981
Maclaren Power	Normick Perron (27% interest) (NP has interests in Donohue Normick Inc.)	20	1981

Continued next page

Acquiring company	Paper company acquired	Estimated value (C$ million)	Year
Repap Enterprises	Manitoba Forestry Resources; & ITT Rayonier Port Cartier, Que. market pulp mill	n.a.	(1981)[1]
Cascade Group	ITT Rayonier Port Cartier mill	n.a.	(1981)[1]
West Fraser	Eurocan Pulp & Paper (40% interest)	+100 (est.)	(1981)[2]
Saskatchewan CIC	Prince Albert Pulp Co. (70% interest; already had 30%)	n.a.	1980
B.C. Forest Prod., Doman Industries & Whonnock Industries	(ITT) Rayonier Canada	420	1980
B.C. Resources	Canadian Cellulose (remaining 19% not owned)	36	1980
	MacMillan Bloedel (20% interest)	+ 100	1980
Noranda Mines	Maclaren Power	240	1980
B.C. Forest Prod.	Donohue-St. Felicien (5% interest; 40% already owned)	n.a.	1980
Oji/Mitsui	New Brunswick Int'l Paper (33% interest)	n.a.	1980
Boxcraft	ITT Rayonier's Port Cartier, Que., mill	n.a.	(1980)[1]
West Fraser	Abitibi-Price (12.9% interest)	n.a.	1979
B.C. Forest Products	Finlay Forest Products (42.7% interst)	n.a.	1979
MacMillan Bloedel	Sturgeon Falls, Ont., mill, boxplants of Abitibi	n.a.	1979
Great Lakes Paper	Dryden, Ont., mill of Reed Paper	80	1979
Abitibi-Price	Stephenville, Nfld. mill from provincial govt.	44	1979
Domtar	Mississauga, Ont., mill, boxplants of Reed Paper	27	1978
Canadian Forest Products	interests in Prince George and Intercontinental Pulp mills in B.C. from Reed Paper	60	1978
Abitibi	Price (remaining 42% interest not owned)	96	1978

1. Parentheses indicate year that possibility of merger was proposed; no agreements have been announced
2. Pending government approval

LABOR

Pulp and paper companies in Canada spend more for labor than their U.S. counterparts. In fact, the British Columbia pulp and paper worker is the highest paid in the world, analysts say.

The base hourly wage in the Canadian forest products industry in 1982 ranged from C$12.96 on the West Coast to $11.38 in eastern Canada. In 1983 a two-year contract ratified in mid-1982 by the Canadian Paperworkers Union locals at Abitibi-Price Inc. became the model for 1982 bargaining. The contract called for the wage in eastern Canada to increase to $12.52 in 1983, when the West Coast mills will be negotiating new contracts. By contrast, the average hourly wage in the U.S. pulp and paper industry in 1982 was $8.60, according to the American Paper Institute, equivalent at mid-1982 exchange rates to about C$10.75/hour.

Canadian pulp and paper industry payroll costs continued to increase at a annual rate of about C$150 million early in the 1980s while the number employed in the industry continued to decline by about 2000 yearly due to improved technology.

CANADIAN PULP & PAPER MILLS EMPLOYMENT AND EARNINGS

Year	Average number employees	Average weekly payroll (000)	Average weekly earnings
1980	82,104	C$35,944	C$438
1979	83,458	33,277	399
1978	82,239	30,243	368
1977	81,702	27,943	342
1976	79,182	24,762	313
1975	68,885	18,590	272
1974	80,653	19,112	237
1973	73,763	15,209	206
1972	73,829	14,247	193
1971	74,636	13,255	178

Source: Canadian Pulp & Paper Assn.

Bargaining pattern. Unions in the Canadian pulp and paper industry tend to wield more power in bargaining then their U.S. counterparts because of a highly centralized bargaining pattern. Bargaining focus in Canada alternates between the East and West, with two-year contracts expiring in the West on odd years and in the East on even years.

There are only a few exceptions to this pattern in cases where companies have ratified one- or three-year agreements with their unions or have two-year contracts expiring in years when the rest of the region's companies are not bargaining.

On the West Coast, companies have formed bargaining groups called the Forest Industrial Relations Ltd. and Pulp & Paper Industrial Relations Bureau to act as an industry-wide bargaining unit. In eastern Canada, however, only four companies have banded together in a bargaining group. Domtar Inc., Reed, Quebec North Shore Paper Co., and James Maclaren refer to their unit as the Eastern Canadian Newsprint Group.

Canadian unions. The largest union in the Canadian pulp and paper industry is the Canadian Paperworkers Union, which has 60,000 members throughout Canada, with 40,000 in eastern Canada. Of that national total, 40,000 are employed in the primary mills, 13,000 in the converting sector, 5,000 in forestry operations and 2,000 in office work.

Other unions include the United Paperworkers International Union, which has only 3,000 members in Canada and the bulk of its support in the U.S., where it has 297,000 members. The CPU broke off from the UPIU in the 1970s. Another major Canadian union is the Pulp & Paper Workers of Canada, with about 7,500 members, most of who are located in British Columbia.

Canadian unions frequently stage prolonged strikes ranging from several weeks to several months to attain their contract demands. In 1981, a six-week strike by 60,000 members of CPU, PPWC, and International Woodworkers of America shut down the entire British Columbia forest products industry. The strike cost companies an estimated C$18 million/day in sales revenue while employees lost in excess of C$8 million/day in earnings.

Aside from the 1981 strike, the West Coast has been hit by five other industry-wide strikes by pulp and paper unions since the 1940s. Two of these were staged by pulp and paper unions and lasted three months each. The IWA has gone out an additional three times, with the longest strike lasting 70 days and the shortest lasting 36 days.

In eastern Canada, the unions usually target a major company to work out a labor contract that will be used in negotiations with other companies that year. Abitibi, the largest paper company in eastern Canada, is the unions' favorite target. In 1975, Abitibi mills were closed during a seven-month strike by the CPU. In 1980, the union again struck Abitibi, but this time for only five weeks. That same year, Domtar mills were struck for seven months.

1982 bargaining. In 1982, Abitibi once again became the union's target, but the condition of the Canadian economy as well as economic malaise throughout the world gave the Abitibi more bargaining clout in reaching a less costly wage agreement. Months prior to the start of bargaining, Abitibi held meetings with its employees to explain the company's financial situation, noting the drop in demand for newsprint and the escalating rate of inflation in Canada. Several of the company's mills were also taking downtime during bargaining.

The meetings with company employees apparently paid off when talks concluded without a strike and union members voted to accept a two-year contract calling for wage increases of 12% the first year and 10% the second year, despite recommendations from CPU leaders to reject the offer. The CPU initially sought wage increases of 40% over a two-year period and later reduced its demand to a minimum of 28% in an attempt to at least reach parity with wages paid to West Coast workers.

British Columbia workers received a 15% wage hike in 1981 and 13% wage hike in 1982 under a two-year contract ratified in 1981. Companies, however, were regretting having agreed to the generous 1981-83 settlement when weak markets caused severe production curtailments beginning late in 1981. Unemployment in sawmills reached 25%. The companies expected to have earnings—already depressed or in some cases non-existent—fall further when the second year's wage increases were set to go into effect in June and July of 1982. The FIR and PPIRB asked unions to defer the this increase for six months, but the request was turned down, and further layoffs were expected.

Other companies set to bargain in 1982 were expected to follow the CPU's wage settlement with Abitibi, but were not agreeing to the pension plan included in Abitibi's contract. CIP, the second-largest company bargaining in eastern Canada in 1982, ratified a new two-year contract with the same wage settlement as Abitibi, but without the Abitibi pension plan. Afterward, other companies followed CIP Inc.'s lead.

The unions appeared to be reluctant to go out on strike in eastern Canada in 1982. Both in the results of strike votes taken at Abitibi mills prior to reaching an agreement and in members' acceptance of an offer well under their original goals, the union's rank and file demonstrated their concern that high wages might lead to more layoffs. A CPU official indicated leaders were watching the Canadian dollar's fluctuations to plan their bargaining strategy. But, with many companies taking significant downtime and price increases failing to meet targeted dates, the companies were obviously not in a position to absorb substantial increases in operating expenses.

Bargaining outlook. In 1983, bargaining will focus on the West Coast, with only a few mills bargaining in eastern Canada that year. Unions are not expected to get the hefty pay increases that they did in 1981. With companies currently trying to persuade the unions to defer wage increases, with many mills reducing production because of weak markets, and in view of analysts' projections that economic conditions won't improve significantly until well into 1982, companies should be in a better position to convince unions to lower their wage expectations.

CANADIAN PAPER WORKERS UNIONS

Union	Region represented	No. of members	No. in primary pulp and paper
United Paperworkers International Union	Canada	3,000	not available
Canadian Paperworkers Union	Canada	60,000	40,000
	(in west	20,000	not available)
	(in east	40,000	not available)
Pulp & Paper Workers	Western Canada	7,500	5,000

Pulp and paper workers are also represented in Canada by such major unions as the Confederation of National Trade Unions, International Assn. of Machinists & Aerospace Workers, International Brotherhood of Electrical Workers, and others

TIMBER RESOURCES, PULPWOOD CONSUMPTION

Canadian pulp and paper mills spent C$2.3 billion in 1980 to buy roundwood, woodchips and wood residues for pulping. Companies harvest from a vast and rich national forestland that extends over about 750,000 square miles in ten provinces. If currently nonproductive forestland were included in Canada's potential forest resource, the figure would be closer to 1.1 million square miles.

The overwhelming volume of the active forestland—just under 92%—is owned by the provincial governments. The balance is held by the federal government (1%) and private landowners (8%). A 1979 estimate by Morgan Stanley analysts Thomas P. Clephane and Jeanne Carroll indicated MacMillan Bloedel to be the largest landholder among pulp and paper companies, with 1.3 million acres held under various licenses and forms of ownership, followed by Abitibi-Price with 951,000 acres, and Domtar with 875,000 acres.

RECENT CANADIAN TIMBER INVENTORY AND CONSUMPTION*

(million cubic feet)

Company	Timber inventory	1979 timber consumption net
Abitibi	966	312
B.C. Forest Products	120	279
BC Timber	—	104
Consolidated-Bathurst	—	182
Domtar	871	183
Fraser	—	67
Great Lakes[1]	456	74
MacMillan Bloedel	4283	397

[1] Includes interest in Pacific Logging

* Data is for 1979, most recent year included in inventory

Source: Morgan Stanley by Thomas Clepane and Jeanne Carroll, June 1980

Timber reserve dwindling. Canada's system of timber ownership is a highly convoluted combination of tree farm licenses, forest licenses, timber sale licenses, timber licenses, ownership in fee, and so on. The various licenses listed above are, in effect, rights to cut standing timber on land held by the Crown, and they are the dominant form of timber control in Canada.

Despite the long-standing tenure held by many companies in particular blocks of land, these licenses no longer imply longevity. In fact, companies are finding provincial governments increasingly willing to turn timberland over to new "owners" if the old users of the land fail to reforest vigorously enough. And since the late 1970s, when work by Les Reed of the Canadian Forestry Service and others revealed that Canada's practically available timber reserve was rapidly approaching zero, governments and companies have launched aggressive programs to build new roads and plant new trees.

Roundwood and chips. Nearly 47% of all wood consumed by Canadian pulp mills consists of softwood roundwood harvested by the mill's own crews or by independent operators supplying wood to the mills. Woodchips represent about 44% of wood consumed and the balance consists of hardwood roundwood and wood residues. Many of the Canadian companies own their own sawmills or are affiliated with sawmill operators, in an attempt to assure long-term timber supplies. Nevertheless, when a big block of timber comes on the market the bidding can be intense—as it was in 1979 when Elk River Timber, with 100,000 acres of Vancouver Island land, was put up for sale by Scott Paper and Crown Zellerbach (going finally to British Columbia Forest Products).

The biggest development in timber supply in Canada in the late 1970s and early 1980s, however, was the decision of the province of Alberta to open about 5 million acres of timberland for development. The first

2.2 million acres of that went to BCFP in 1979 for construction of sawmills and a newsprint mill, and the second block, of 2.5 million acres, was opened for proposals in two sections in 1981. Eight proposals had been received by the government by the closing date in mid-1982.

Indeed, so scarce was undeveloped timberland that by 1982 it was believed that only two remaining sites for pulp mills existed in southern British Columbia, and the same or less in most other provinces. Future construction of new mills is expected to depend on higher end-product prices to make it economical to harvest distant and isolated remaining stands, or on the coming-of-age of mechanical pulping processes that can use hardwood for producing top-quality printing/-writing papers, newsprint and paperboard.

CANADIAN PULPWOOD CONSUMPTION

(000 cunits)[1]

	Roundwood	Wood residue	Total
1980p	15,956	14,756	30,712
1979	15,860	14,498	30,358
1978	15,476	13,275	28,751
1977	14,845	11,975	26,820
1976	14,852	12,304	27,156
1975	13,950	8,495	22,445
1974	17,960	10,701	28,661
1973	16,879	9,883	26,762
1972	16,427	8,437	24,864
1971	15,978	7,405	23,383
1970	17,070	6,140	23,211

1. Cunit is 100 ft^3 of solid wood, excluding bark
p Preliminary data

Source: Canadian Pulp & Paper Assn.

PULPWOOD AND WOOD RESIDUE CONSUMPTION BY CANADIAN MILLS, 1980

(000 cunits)

Pulp process	Softwood roundwood	Hardwood roundwood	Woodchips	Other wood residues	Total
Mechanical	6,538	n.a.	379	65	6,982
Sulfite	2,064	n.a.	1,892	n.a.	3,956
Sulfate and soda	5,677	1,422	11,097	1,283	19,479
Total	14,279	1,422	13,368	1,348	30,417
Value (C$ millions)	1,207	90	975	47	2,319

n.a. = not available; withheld by StatCan to protect confidentiality of companies, and included within figures for other pulping processes.

Source: Statistics Canada

ENERGY USE AND CONSERVATION

Canada's pulp and paper industry made little progress in improving its energy efficiency in 1981, due to a combination of a deep recession beginning in the second half of the year and a seven-week strike that paralyzed the British Columbia sector of the industry.

As a result, while the Canadian industry had cut its purchased energy consumption by 17.2% from 1979 through 1980, that percentage had not changed by the end of 1981. The industry still hoped to achieve a voluntary goal of reducing energy purchases 30% by the end of 1984, but one source conceded the continuation of the recession into the second half of 1982—forcing most manufacturers to postpone "nonessential" expenditures like those aimed at energy conservation—was endangering that timetable.

Government pressure to conserve energy was not by any means the only reason for the industry's desire to improve its energy efficiency, of course. In 1973 the cost of fuel and electricity for the industry rose by 10.7%—and then in 1974 it exploded, going up 51.2% in a single year. The total increase from 1972 to 1980 was 324.3%, according to Statistics Canada. Those costs were still going up at the uncomfortably fast pace of 15.2% in 1979 and 12.8% in 1980, reaching C$1.037 billion in that year.

CANADIAN PAPER INDUSTRY ENERGY COSTS, 1972-84

(C$/metric ton of product)

	1984e	1977	1974	1972
Electricity	26.60	12.58	6.80	5.65
Residual fuel	26.25	11.33	7.58	3.78
Natural gas	15.40	5.42	2.12	1.40
Others	—	2.07	1.34	0.98

e = Estimated

Source: Canadian Pulp & Paper Assn.

The dramatic climb in energy costs during the decade led most mills to explore virtually every practical avenue for decreasing the amount of purchased energy needed to manufacture a ton of product, although the industry is still behind in this race—purchased fuel and electricity represented about 7% of the total cost of production in 1979. And according to Statistics Canada that had grown to about 10% in 1980, due to the runaway oil pricing of the 1970s.

The largest portion of the industry's 1980 energy bill consisted of C$426 million spent on electricity (up from C$363 million in 1979). Another C$357 million was spent on heavy fuel oil (C$334 million in 1979) and C$176 million on natural gas (C$160 million in 1979), with the balance going for coal and other fuels. The approach many mills were taking was to increase their ability to burn production byproducts and forestry wastes, and mills in 1982 were already generating almost half their own energy through hogged fuel boilers, black liquor boilers and the like.

Pulp & Paper estimates indicate that at the beginning of 1982, Canadian mills had budgeted C$585.8 million for energy- and power-related capital projects in the 1981-83 period, including projects already announced through 1986. That equaled about 10.5% of all planned capital expenditures for the period, although energy projects were no doubt among those hard-hit by capital spending cuts made by most Canadian companies in the recessionary environment of the first half of 1982.

Of the energy and power projects originally planned for the 1981-86 period, 35% were to be in the Maritime Provinces, 29% in Ontario, 20% in the western region and 16% in Quebec.

CANADIAN PAPER INDUSTRY CAPITAL SPENDING ON ENERGY AND POWER PROJECTS, 1981-83*

Region	Expenditures (C$000)	% of total energy/power capital budgets
Maritimes	C$205,659	35%
Quebec	94,242	16
Ontario	166,648	29
Central	—	—
West	119,248	20
Total	585,797	100
% of total capital spending, all purposes	10.5%	—

* Includes projects, as announced, for 1984-86

Source: PULP & PAPER January 1982 Capital Spending Survey

CANADIAN PAPER INDUSTRY PURCHASED FUEL AND ENERGY, 1976 & 1977

(C$000)

Energy source	1977	% of total value of shipments	1980	% of total value of shipments
Coal and coke	13,956	0.2 %	—	—
Natural gas	115,172	1.7	176,000	1.6%
Gasoline	1,738	0.03	—	—
Kerosene	603	0.01	—	—
Diesel oil	3,351	0.05	—	—
Light fuel oil (Nos. 2, 3)	5,034	0.08	—	—
Heavy fuel oil (Nos. 4,5,6)	240,761	3.6	357,000	3.3
Liquified petroleum gases	2,477	0.04	—	—
Electricity purchased	267,427	4.0	426,000	3.9
Other fuel (including steam purchased)	17,024	0.3	—	—
TOTAL FUEL & ELECTRICITY	667,543	10.1	1,036,754	9.5

(— = not available)

Source: Statistics Canada

CHEMICAL USE

Chemicals made up 16.2% of the total cost of materials and supplies for the Canadian pulp and paper industry in 1980, representing a C$746-million expense for the industry, according to Statistics Canada figures. Of that figure, **caustic soda** claimed by far the biggest share, 21.7% in terms of value. This percentage has remained stable in recent years: in 1977, for example, it was 20.8%. Volume estimates for total chemical consumption are less meaningful, but in those terms, caustic soda is also most important, representing 951,019 metric tons in 1980, up 31.4% from 1977.

A study by market research firm Predicasts Inc. forecasts a further 23% rise in Canada's caustic soda consumption by 1985. The study predicts a similar rise in **chlorine** consumption, for bleaching purposes, while it concedes a trend in the pulp and paper industries of developed countries towards **sodium chlorate**, **hydrogen peroxide** and **oxygen** bleaching, caused by the rising cost of chlorine.

Sodium chlorate is used in pulp mills to generate **chlorine dioxide**, an increasingly popular bleaching agent. Between 1977 and 1980, while chlorine consumption was rising 15.0% in terms of volume, to 560,212 tons, according to StatCan, volume of sodium chlorate consumed rose 38.7%, to 200,295 tons.

The price of sodium chlorate was expected to grow 10% in 1982 in Canada, while chlorine was expected to go up 15%, according to a study by PULP & PAPER consulting editor Barry Shockett. Most dramatic price increases, however, were expected to be in the **petrochemical-base** products, especially the **synthetic binders** and **sizes**, along with **wet-strength additives**, **surface sizes** and **dry-strength additives**. Pushing petrochemical prices up at a dramatic pace—and expected to continue doing so over the next five years—was an agreement between the oil-rich province of Alberta and the federal government allowing for huge increases in the price of newly discovered oil.

Other chemical cost increases were expected to be stiff as well, particularly the 30% rise seen in caustic soda, caused by caustic shortages that resulted from poor demand for caustic's coproduct, chlorine.

Major pulp and paper industry chemicals, with pricing and late 1981 availability, include the following:

Aluminum sulfate, $111-$132/metric ton, liquid, f.o.b. Valleyfield, Que., availability: adequate. **Caustic soda**, $293-$381, 50% solution, bulk, f.o.b. works, freight-equalized; availability: demand greater than supply and in some cases on allocation. **Chlorine**, $225-$254/ton, bulk, f.o.b. works; availability: excellent. **Hydrogen peroxide**, 38¢-42¢/lb, bulk, 50% solution, f.o.b. Toronto; availability: supply/demand in balance. **Hydrosulfites, borohydride solution**, blended, 59¢-64¢/lb, delivered, eastern Canada; nonblended, 66.4¢-71.5¢; availability: supply/demand in balance. **Kaolin clay**, water-washed No. 1 coating grade, US$215-$218/ton, f.o.b. Georgia; dry-ground, air-floated, filler grade, $47-58/ton; availability: supply/demand in balance.

Lime, $46-$51/ton, bulk, f.o.b. plant; availability: supply/demand in balance. **Saltcake**, $55-$70/ton, bulk saltcake, f.o.b. works; availability: supply/demand in balance. **Sodium chlorate**, $365/ton, works, freight equalized; availability: supply/demand in balance. **Starch**, native pearl, $19.25-$21.50/100-lb bags. f.o.b. Toronto/Montreal; availability: supply/demand in balance. **Sulfur**, crushed, slate or molten, $60-$75/long ton, f.o.b. producing point; availability: tight to good. **Sulfuric acid**, 66 Baume, $69.31-$77.79/ton, bulk, f.o.b. producing points, eastern Canada; availability: tight to good. **Titanium dioxide**, untreated anatase, $69-$74.50/100 lb, delivered, bags; availability: supply/demand in balance.

MAJOR CHEMICAL SUPPLIES USED BY CANADIAN PULP & PAPER INDUSTRY, 1977 and 1980

(C$000)

Material or chemical	1977	1980
Caustic soda	97,430	161,484
Liquid chlorine	59,044	89,796
Sodium chlorate	39,648	74,865
Saltcake	22,574	24,179
Starch	17,794	26,496
Sulfur	16,196	23,611
Foam & slime killers	13,197	32,355
Sulfuric acid	11,990	20,034
Other mat. and chem.	190,043	293,059
TOTAL	467,916	745,879

Source: Statistics Canada

TRANSPORTATION

Canadian pulp, paper and paperboard mills moved about 58% of their shipments by rail in 1981, a lower proportion than in the U.S. because many Canadian mills are located on or very close to water and move their products by ocean vessel to their export customers. As in the U.S., some Canadian mills are finding that the economics and convenience of trucking has become more attractive in recent years, but truck remains a less favored transport mode than rail and ship because Canadian mills are more dependent on export business than are their U.S. competitors.

The forest products industry is among the Canadian rail industry's most important customers. In 1981, the 629,000 cars loaded with forest products represented 17.4% of Canada's total 3.6 million carloadings, although this was down from the 20.0% share of 1978. The 6.1% of all carloadings represented by pulp and paper products alone in 1981 was unchanged from 1978, however, with the decline in the overall forest products group being registered largely in the log, lumber and plywood sector.

Unlike their U.S. counterparts, Canadian mills have enjoyed a more stable transportation environment during the last decade due to the near-total deregulation of Canadian transport industries by the National Transportation Act of 1967. That does not mean transport cost increases have always been moderate—by one estimate, between 1979 and 1982 the typical British Columbia newsprint mill saw its costs for shipping a ton of paper to consumers rise by 41%. But this was less than the 46% rise during the same period in the U.S. Bureau of Labor Statistics' rail freight price index for all U.S. pulp, paper and allied products.

And indeed, not all the results of deregulation have been beneficial for the industry. Paper industry transport officials say the current setup leaves shippers such as paper mills with little recourse in case of a complaint against a railroad other than a full-fledged "Section 23" hearing—named after the section of the National Transportation Act—which can be an expensive, time-consuming process, complete with lawyers, volumes of documentation and countless delays.

Mills that have a problem with a particular rate can ask the railroad to go into mediation, but paper industry officials note that railroads have little incentive to do so. And faced with the alternative of accepting the rate or seeking a Section 23 hearing, mills have often acquiesced in the railroad's action.

To sort out this problem, paper industry officials have proposed a binding arbitration procedure, which they say could be made to be less cumbersome than the Section 23 process. Faced with this and other pleas for reform, railroads reply that under the current law, the authority of the Canadian Transport Commission is too narrow to permit such action.

But pulp companies recently took a case to the Canadian Supreme Court which, one industry official said, finally established that the Commission does have broader rights than previously thought. In that case, pulp companies felt they had been overcharged for shipments to the tune of C$15 million between 1976 and 1981, and asked the Commission to slap down the charges in question. The Commission threw out the objectionable charges, although it still did not have the authority to order refunds. After the Supreme Court supported the right of the agency to invalidate the charges, the pulp companies went to court in mid-1982 to recover the C$15 million.

Another action of the CTC did not please the paper industry as much. Following a disastrous spill of non-paper industry hazardous wastes in Ontario in 1981, the agency began the process of tightening up rules for transport of hazardous wastes, including some paper industry supplies. The proposed rules, many of which went into effect over industry objections, include speed slowdowns in developed areas, installation of special couplers and other modifications. Industry officials fear the end-result of those regulations will be added chemical costs for mills.

CARLOADING OF MAJOR CANADIAN RAILROADS, 1978-81

	1981	1980	1979	1978
(000 cars loaded)				
Pulp & paper	219	227	231	228
Pulpwood	205	233	233	230
Other forest products	205	241	262	289
Total forest products	629	702	726	747
All rail carloadings	3,609	3,796	3,889	3,737
(000 metric tons)				
Pulp & paper	11,647	11,888	11,917	11,694
Pulpwood	11,156	12,563	12,550	12,233
Other forest products	9,713	10,935	11,816	12,864
Total forest products	32,516	35,386	36,283	36,729
Total traffic loaded	253,743	236,164	237,380	218,783

Source: Statistics Canada

ENVIRONMENTAL SPENDING AND REGULATIONS

Canadian pulp and paper mills planned to spend C$803 million on environmental projects in the first half of the 1980s, nearly 15% of total announced capital expenditures, according to a January 1982 PULP & PAPER survey covering the years 1981-83, including announced projects through 1986.

Portions of that air and water cleanup budget may have been deferred for a period of time by the deep recession that continued through the first half of 1982, but government pressures were not expected to permit any substantial shift from the industry's drive to reduce its environmental impact.

Of the announced budget, 50.7% was intended to improve water quality, 45.4% to clean up air emissions and 3.9% to resolve solid waste disposal problems. The regional breakdown for these environmental expenditures is as follows: **water quality:** Maritimes, 11% of nation's expenditures; Quebec, 32%; Ontario, 23%; western provinces, 34%; **air quality:** Maritimes, 15%; Quebec, 23%; Ontario, 21%; West, 41%; **solid waste:** Maritimes, 0.4%; Quebec, 99.6%.

The differences between provinces partly reflect priorities of the various provincial governments, and partly reflect the priorities and abilities of the paper companies themselves. One industry official said, however, that over the long run the provinces are roughly equal in their insistence on continued environmental improvement. Canadian industry enjoys a less adversarial relationship with government in general than does U.S. industry, one observer claimed, noting that the provinces often prefer negotiating mill cleanup programs case-by-case rather than simply mandating behavior across the board. But the final effect, while slower, is the same, say Canadian industry officials.

One difference between Canada and the U.S. is that in Canada the major power in regulating the environment is the province rather the federal government. This can mean, of course, that mills are sometimes more successful at using the "jobs-environment tradeoff" argument than they might be in the U.S.

Canadian governments also impose "guidelines" rather than hard-and-fast regulations on existing facilities in some cases, while applying them as regulations for new construction. But still, existing mills have come close to meeting Canadian air and water quality standards, and nearly all of the industry would have been in compliance with existing guidelines and regulations by the end of 1983 if it were not for the 1982-83 recession. Some mills would still have been out of compliance in some categories of air quality by the end of 1983, but now it is expected the industry will go well into 1984 or beyond before coming into substantial compliance.

In some ways Canada has chosen to go easy on environmental control strategies that U.S. industry finds costly and time-consuming to execute. Air quality modeling, for example, is not widely favored in Canada, one executive noted, while air quality monitoring requirements vary—in some provinces, ambient air monitoring systems are used to trigger control action, while in other cases emissions monitoring is more important because the provincial government is more interested in "end-of-pipe" or facility-specific emissions.

Another U.S. environmental headache that does not seem to plague many Canadian mills is the question of how clean coal must be before it can be burned in power boilers since few Canadian mills use coal. That also exempts the forest products industry from much concern over the current sulfur-dioxide/acid-rain debate. And unlike the U.S., where the government is pushing industrial power generators to switch oil boilers to coal, the Canadian government—interested in boosting a domestic petroleum industry and well aware that most of Canada's coal is located far from industrial facilities—has shown no great desire to push mills into consuming coal.

This is not to say Canadian mills don't have ongoing disagreements with the government over specific environmental problems and policies. A few examples:

- In 1980 Parliament enacted the Transportation of Dangerous Goods Act, creating tight new labeling and packaging rules for hazardous materials shipments—

and including the owner (such as the paper mill) as well as the transporter (railroad or truck line) in potential liability in the event of a spill. With many chemicals—including such hazardous materials as molten sulfur—purchased on an f.o.b. point-of-origin basis, mills faced a choice between buying c.i.f. if they could and paying steeper insurance rates.

With pulp and paper mill byproducts such as tall oil also classified under the act as hazardous substances, mills themselves faced additional hazardous waste spill liability worries.

- In mid-1981, BC Timber announced a program—after prolonged negotiations with provincial authorities—under which it would spend C$43 million over six years to clean up its Prince Rupert, B.C., mill, and C$32 million to clean up its Castlegar, B.C., facility. Modifications were to include a new scrubber and two electrostatic precipitators at Prince Rupert, plus a clarifier for suspended solids; and an electrostatic collector for a woodwaste boiler plus a 30-acre biological treatment lagoon for Castlegar.
- Another mill with environmental problems, Reed Paper Ltd.'s Quebec City, Que., facility—located right in Quebec City—announced in late 1981 it was in the middle of a C$39-million program to clean up its air and water emissions, including addition of scrubbers to cut emissions of sulfur dioxide and particulates, and expansion of the mill's adjacent Lignosol plant to consume more of the mill pulp-washing system's liquid residue.

Such reports could be repeated about mills all over Canada. Any number of Canada's older mills have been virtually kept in business by the reluctance of government authorities to shut down a polluter which also happens to be a major local employer. But the similarity of long-term goals of U.S. and Canadian regulators may be seen by the fact that the percentage of total capital expenditures going to environmental programs in Canada, at just under 15%, is actually higher than the nearly 13% planned by U.S. firms.

CANADIAN PAPER INDUSTRY SPENDING FOR 1981-83* POLLUTION ABATEMENT EQUIPMENT, BY REGION

(C$000)

Region	Water	Air	Solid waste	Total
Maritimes	43.7	53.5	0.1	97.3
Quebec	132.4	82.1	31.0	245.5
Ontario	92.6	78.0	—	170.6
Central	0.03	—	—	0.03
West	138.5	151.0	—	289.5
Total	407.2	364.6	31.1	802.9
% of total capital spending	50.7%	45.4	3.9	100%

* Includes projects, as announced, for 1984-86 period

Source: PULP & PAPER January 1982 Capital Spending Survey

PAPER GRADES

Five major groupings make up the paper segment of the pulp, paper and paperboard industry: (1) newsprint, (2) printing papers, (3) fine or writing papers, (4) packaging and converting papers, and (5) tissue papers. That rough breakdown arranges paper grades according to their overall end-use, but it accepts the industry convention which separates newsprint, the crudest and least expensive publication paper, from the rest of the printing paper sector. This convention has some reason behind it: newsprint mills produce a simpler product than other printing paper mills, with fewer value-added systems such as coaters or supercalenders. Newsprint is also consumed only by newspapers, whereas all other printing papers compete in several markets. Uncoated groundwood, for example, is used in newspaper inserts, catalogs, directories, magazines and small office printers.

But while that breakdown will serve for a general discussion of papermaking and paper markets, a more detailed look requires that a distinction be made among papers according to how they are made and the specific end-use for which they are intended. It is important to take any classification, of course, with a grain of salt. For example, it is not always easy to separate paper and paperboard grades into their respective groups. For instance, some paper grades, such as bristols, have basis weights similar to paperboard grades.

This report relies on classifications established by the U.S. Bureau of the Census and those used by American Paper Institute (API) and Canadian Pulp & Paper Assn. (CPPA). These classifications distinguish, for example, uncoated free-sheet—source of most fine papers but also of a large volume of printing papers for certain uses—from coated paper, used almost exclusively for publishing and commercial printing. They also draw a line between coated publication papers and uncoated groundwood paper—both used widely for magazines, catalogs, newspaper inserts and the like, but representing opposite ends of the publication-paper price spectrum, and thus intended for completely different types of publications.

It is also important from the papermaker's point of view to distinguish, for example, between free-sheet papers—made with little or no mechanical pulp—and groundwood papers, commonly made with stone groundwood or thermomechanical (TMP) pulp, or between the wood fiber papers that make up better than 95% of all paper and the cotton fiber papers that make up a small but stable sector of the fine paper sector.

Therefore this report will approach the paper side of the industry by looking at eight major subgroupings that are commonly understood and accepted in the paper industry:

- Newsprint
- Uncoated groundwood papers
- Coated papers
- Uncoated free-sheet papers
- Cotton fiber papers
- Bristols
- Packaging and industrial converting papers
- Tissue

Each chapter will examine detailed production and market distinctions within these categories, and will examine any important trends in production technique or end-use.

Some generalizations apply to the entire paper sector. Paper grades are generally produced on fourdrinier paper machines or twin-wire formers, but in a few cases cylinder board machines or multi-ply formers are used instead. Paper machines exist in all sizes and configurations, according to the single grade of paper to be produced or even a papermaker's particular requirements for his own product.

The process seems very simple: a slurry of fibers and water is drained (dewatered) on a wire, after which further excess water is removed by pressing and drying. The dried sheet is then wound on a reel from which rolls or sheets of paper are produced.

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But in reality, papermaking is a complex process, combining sophisticated and evolving technology and decades of experience.

The intent of this report is not to discuss papermaking in detail; numerous technical reference books exist for this purpose. The main purpose of this work is to provide the reader with an overall introduction to the most important sectors of the paper industry, with discussions elsewhere in the book of important themes for the entire pulp, paper and paperboard industry.

While reading chapters on particular grades of paper, however, the reader should keep in mind that no two mills make the same grade of paper by the same exact method or equipment.

One mill may make newsprint with a twin-wire former using 100% wastepaper while other mills may produce a similar quality of newsprint with a fourdrinier machine and groundwood pulp. Some paper mills are modern, using the most up-to-date, large-scale equipment available, whereas other paper mills make similar grades on small equipment at 100-year-old sites—still in operation because they serve a particular market need, and because using entirely paid-for equipment permits them to do so economically.

U.S. PRODUCTION AND CAPACITY FOR PAPER GRADES

(000 short tons)

	Production[1]		**Capacity**[2]		
	Tonnage	**% change**	**Tonnage**	**% change**	**Utilization rate (%)**
1983	—	—	35,746	2.3%	—
1982	—	—	34,927	3.8	—
1981e	30,850e	1.9%	33,639	3.0	91.7%
1980	30,281	0.9	32,659	4.7	92.7
1979	30,012	5.3	31,179	2.4	96.3
1978	28,506	1.4	30,460	2.1	93.6
1977	28,096	5.5	29,831	2.1	94.1
1976	26,612	14.1	29,210	0.9	91.1
1975	23,306	−12.6	28,922	1.3	80.5
1974	26,674	0.7	28,532	3.2	93.4
1973	26,483	4.1	27,621	1.7	95.3
1972	25,435	6.8	27,156	3.3	93.6
1971	23,811	0.7	26,270	1.7	90.6
1970	23,625	0.1	25,806	2.1	91.5
1969	23,596	—	25,257	—	93.4
Average 1971-81		2.6%		2.4%	

1. Census data. Includes newsprint, printing & writing, packaging & industrial papers and tissue
2. American Paper Institute
e = P&P estimate

U.S. PRODUCTION OF PAPER GRADES, 1981-77

(000 short tons)

	1981p	1980	1979	1978	1977
TOTAL, ALL GRADES	30,850	30,164	29,580	28,506	28,906
PRINTING, WRITING AND RELATED PAPERS	20,910	20,362	19,271	18,482	17,923
Newsprint	5,275	4,660	3,778	3,489	3,525
Groundwood paper, uncoated	1,413	1,538	1,800	1,569	1,588
Publication and printing	1,142	—	—	—	—
Supercalendered	—	156	161	324	334
Other	—	1,138	1,420	1,030	1,086
Body stock for coating					
Other converting and miscellaneous groundwood	270	243	220	214	168
Coated printing and converting paper	4,975	4,751	4,580	4,513	4,215
Coated groundwood (more than 10% groundwood)	2,802	—	—	—	—
Coated one side	129	123	118	—	—
Coated two sides	2,673	2,572	2,307	—	—
Coated free-sheet (not more than 10% groundwood)	2,210	—	—	—	—
Coated one side	381	356	364	477	439
Coated two sides	1,829	1,700	1,791	—	—
Prime coated body stock for further coating					
Uncoated free-sheet (not over 10% mechanical fiber)	7,872	8,008	7,655	7,315	7,036
Writing (chemical woodpulp)	3,702	4,066	3,815	3,589	3,524
Bond and writing, including protective check	—	1,616	1,447	1,415	1,322
Forms bond in rolls	—	1,327	1,330	1,179	1,191
Ledger	—	107	117	63	67
Mimeograph (all woodpulp furnishes)	—	98	88	103	119
Gelatin and spirit process duplicating	—	301	234	196	166
Papeterie and wedding	—	48	62	55	48
Body stock for communication, copying papers	—	356	307	169	171
Other technical and reproduction papers	—	122	126	157	153
Onionskin and manifold	—	4	6	8	7
Opaque circular	—	14	17	23	15
Other	—	73	82	219	264
Publication and printing	2,220	2,127	2,048	2,199	2,082
Plain (MF, EF, antique, bulking, super-calendered, etc.)	—	(D)	(D)	201	147
Offset	—	1,930	1,837	1,987	1,921
Other book printing paper	—	(D)	(D)	11	14
Book converting paper	—	(D)	(D)	—	—
Cover and text papers	238	263	280	219	196
Other converting, misc uncoated free-sheet	(D)	(D)	(D)	1,308	1,234
Envelope (white woven)	—	620	659	609	623
Kraft envelope, bleached and brown	—	272	205	212	195
Tablet	—	315	299	219	203
Other	—	(D)	(D)	260	198
Bleached bristols, incl cotton fiber index and bogus	984	941	957	1,127	1,108
Tabulating card stock	—	202	217	311	338
Tag and file folder	471	285	310	313	280
Tag	—	196	199	214	191
Folder	—	89	112	99	90
Other uncoated bristols	239	222	188	239	232
Index	—	197	163	213	205
Printing	—	(D)	23	25	24
Postcard	(D)	—	2	1	2
Coated bristols	275	232	242	264	258
Cotton fiber writing paper and thin paper	455	464	502	469	450
Writing, cotton fiber, including cotton fiber index	118	131	130	119	111
Bond and writing	—	93	91	86	82
Ledger	—	4	4	5	5
Onionskin and manifold	—	3	4	3	3
Papeterie and wedding	—	3	3	3	2

U.S. PRODUCTION OF PAPER GRADES, cont.

	1981p	1980	1979	1978	1977
Body stock for communication, copying papers	—	10	9	3	3
Other technical and reproduction paper	—	8	8	9	8
Index	—	3	3	3	2
Other	—	7	7	8	7
Thin paper	337	333	371	350	339
Carbonizing, free from groundwood pulp	—	196	238	224	212
Cigaret, condenser, other	—	137	134	126	127
PACKAGING AND INDUSTRIAL CONVERTING PAPER	5,433	5,327	5,708	5,778	5,930
Unbleached packaging, industrial converting	3,621	3,718	3,911	3,872	4,061
Wrapping	142	137	187	210	218
Shipping sack	1,083	1,062	1,110	1,019	1,073
Bag and sack other than shipping sack	1,990	2,101	2,115	2,092	2,212
Grocery bag and sack paper	—	2,074	2,085	2,064	2,182
Other unbleached kraft bag paper	—	27	30	29	30
Other converting (18 lb and over)	410	419	499	551	558
Asphalting paper	—	176	215	173	179
Coating and laminating	—	40	25	22	14
Gumming stocks	—	63	80	51	66
Twisting and spinning stock (18 lb and over)	—	(D)	(D)	(D)	(D)
Waxing stock (18 lb and over)	—	(D)	(D)	(D)	(D)
Other converting	—	105	141	271	266
Packaging, industrial converting, except unbleached kraft	1,310	1,145	1,266	1,408	1,346
Wrapping	120	103	119	155	136
MG and MF wrapping papers, butchers papers	—	95	109	127	122
Miscellaneous wrapping	—	8	10	28	15
Shipping sack, including comb. kraft and rope	85	92	102	92	107
Unbl and bl sulfite, semibl and bl kraft, & mixtures	—	(D)	(D)	(D)	(D)
Other shipping sack paper	—	(D)	(D)	(D)	(D)
Other bag and sack	242	229	250	273	304
Grocery bag and sack	—	155	170	217	198
Other	—	73	80	55	106
Other converting (18 lb and over)	265	251	287	264	236
Gumming stock	—	32	34	23	14
Twisting and spinning stock (18 lb and over)	—	(D)	(D)	(D)	(D)
Waxing stock (18 lb and over)	—	98	113	76	69
Coating and laminating	—	(D)	(D)	116	100
Other, such as asphalting and creping stock	—	52	59	—	—
Specialty packaging	333	269	273	365	344
Glassine, greaseproof, and vegetable parchment	256	202	234	259	219
Special industrial paper	504	464	531	498	524
TISSUE	4,507	4,474	4,601	4,246	4,243
Sanitary paper	4,332	4,298	4,403	4,036	4,045
Toilet tissue	1,673	1,706	1,772	1,629	1,605
Single-ply	—	939	978	939	877
Multi-ply	—	766	794	690	729
Facial tissue, other than toweling, napkin, and toilet	376	370	376	383	365
Napkin	553	532	533	429	470
Single-ply	—	409	404	317	353
Multi-ply	—	123	129	112	117
Toweling, excluding wiper stock	1,426	1,439	1,482	1,375	1,388
Sanitary napkin stock wadding	—	103	98	87	73
Wiper stock, regular, facial, and wadding type	—	74	63	57	48
Other sanitary stock	306	74	78	76	96
Tissue paper, excluding sanitary and thin	173	176	198	210	197
Wrapping tissue	—	72	63	75	74
Waxing tissue stock	—	24	31	32	28
Twisting tissue stock	—	13	14	12	9
Fruit and vegetable wrap	—	(D)	(D)	(D)	(D)
Pattern tissue stock	—	(D)	(D)	(D)	(D)
Creped wadding for interior packaging	—	25	41	37	35
Other tissue paper, excluding sanitary and thin	—	18	21	29	28

p Preliminary
(D) Withheld to avoid disclosing figures for individual companies

Source: Bureau of the Census

CANADIAN PRODUCTION AND CAPACITY FOR PAPER GRADES

(000 short tons)

	Production[1]		Capacity[1]	
	Tonnage	% change	Tonnage	% change
1983	—	—	14,934	4.2%
1982	—	—	14,337	6.2
1981e	12,429	1.9	13,502	4.0
1980	12,200	−0.5	12,975	0.9
1979	12,259	0.9	12,855	2.0
1978	12,148	9.0	12,603	0.9
1977	11,146	3.6	12,493	0.8
1976	10,757	17.1	12,396	1.0
1975	9,186	−22.0	12,275	0.9
1974	11,782	6.0	12,168	−1.0
1973	11,120	3.9	12,292	1.4
1972	10,700	4.7	12,121	—
1971	10,215	− 1.4	—	—
1970	10,357	− 0.1%	—	—
1969	10,372	—	—	—

1. Excludes building papers
e = P&P estimate

Source: Canadian Pulp & Paper Assn.

CANADIAN PAPER PRODUCTION

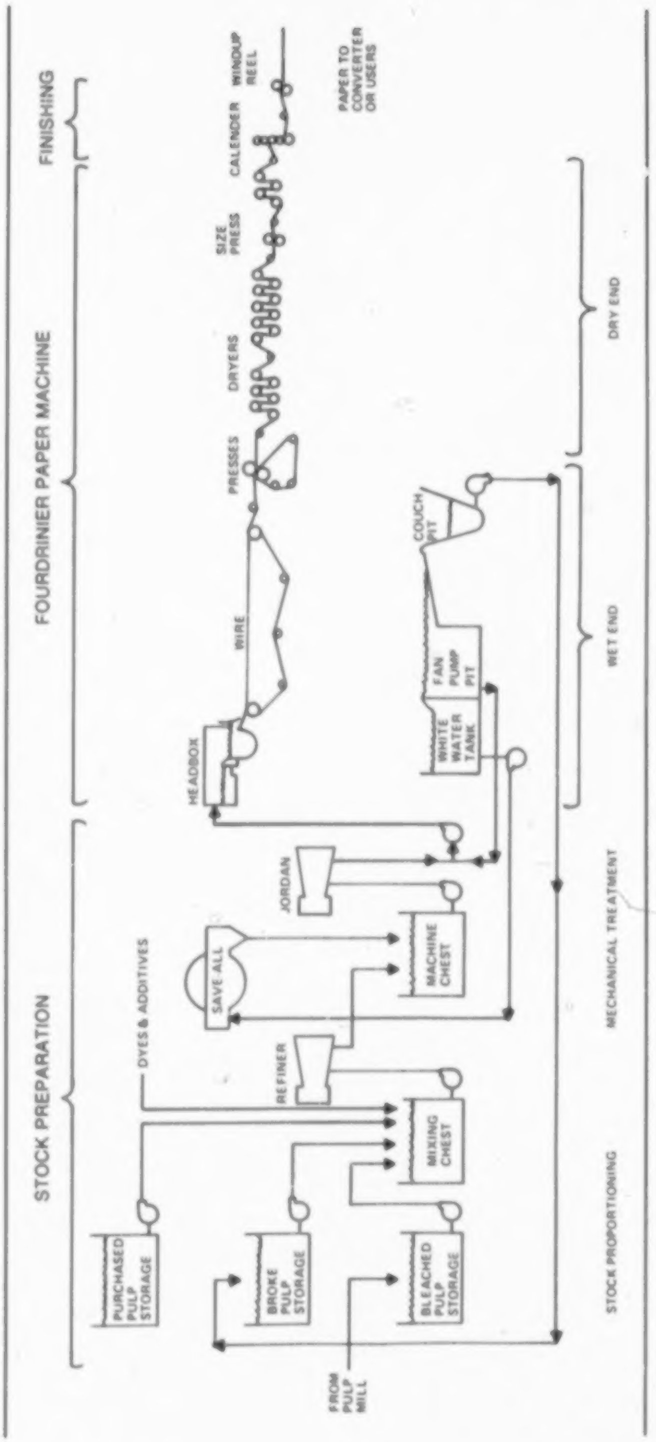
(000 short tons)

	Newsprint	Groundwood printing/ specialty	Other book & writing	Wrap-ping papers	Tissue/ sanitary	Building papers	Total
1981	9861	711	866	563e	428	135e	12,564
1980	9507	677	987	613	416	140	12,340
1979	9551	624	1008	668	408	138	12,397
1978	9670	580	871	637	390	142	12,290
1977	8988	463	759	571	365	155	11,301
1976	8915	384	544	580	335	165	10,923
1975	7679	311	437	475	283	161	9,346
1974	9548	416	748	709	361	158	11,940
1973	9140	222	762	671	324	163	11,282
1972	8820	296	675	597	312	172	10,872
1971	8455	299	631	540	289	147	10,361
1970	8719	289	616	493	240	101	10,458
1969	8818	214	544	514	281	116	10,487

e = P&P estimate

Source: Canadian Pulp & Paper Assn.

TYPICAL FLOW DIAGRAM FOR A FINE PAPER MILL


STOCK PREPARATION
FOURDRINIER PAPER MACHINE
FINISHING
PURCHASED PULP STORAGE
BROKE PULP STORAGE
BLEACHED PULP STORAGE
FROM PULP MILL
DYES & ADDITIVES
MIXING CHEST
REFINER
SAVE ALL
MACHINE CHEST
JORDAN
HEADBOX
WHITE WATER TANK
FAN PUMP PIT
WIRE
COUCH PIT
PRESSES
DRYERS
SIZE PRESS
CALENDER
WINDUP REEL
PAPER TO CONVERTER OR USERS
STOCK PROPORTIONING
MECHANICAL TREATMENT
WET END
DRY END

VALUE OF SHIPMENTS OF PRIMARY PAPER PRODUCTS

($ million)

	1979	1978	1977	1976	1975	1972
TOTALS[1]	15,784	13,536	12,438	11,360	9,370	6,182
Newsprint	1,226	1,040	989	899	828	506
Uncoated groundwood	723	594	539	480	403	233
Publication/printing	—	—	—	—	—	201
Others	—	—	—	—	—	32
Coated printing & converting	2,825	2,572	2,261	1,953	1,473	1,205
Coated one side	—	—	—	—	—	145
Coated two side	—	—	—	—	—	880
Uncoated printing/writing[2]	4,666	3,762	3,353	3,575	2,845	1,961
Writing, chemical pulp	—	—	—	—	—	818
Publication/printing	—	—	—	—	—	551
Cover/text	—	—	—	—	—	91
Other	—	—	—	—	—	196
Book paper	—	—	—	1,358	1,073	—
Cotton fiber and thin	645	536	496	—	—	291
Bleached bristols	502	504	474	415	355	244
Unbleached kraft packaging[3]	1,244	1,138	1,099	1,041	873	603
Packaging and converting[4]	760	627	561	519	439	379
Special industrial	575	523	551	464	389	272
Tissue	2,618	2,241	2,116	2,014	1,765	946

1. Totals are higher than individual values to to inclusion of nonclassified grades
2. Uncoated free sheets
3. Plus industrial converting papers
4. Except unbleached kraft

PUBLICATION PAPER SHIPMENTS ACCORDING TO PRINTING TECHNOLOGY, 1980

(% of total for each grade)

Grade	Offset	Letterpress	Rotogravure
Coated two-sides Nos. 1-4	96	1	3%
Coated two-sides No. 5	55	24	21
Uncoated free-sheet	96	4	—
Uncoated groundwood	44	35	21
Newsprint*	25	57	n.a.

* American Newspaper Publishers Assn. estimate for percentage of total U.S. newsprint consumption used by U.S. daily newspapers for each method of print in 1979, latest available year. Does not include consumption by government, or preprinted inserts or other consumers.

n.a. = not available

Source: PULP & PAPER estimate

ESTIMATED NUMBER OF U.S. MACHINES PRODUCING PAPER GRADES[1]

	Machines in 1975		Machines in 1980	
	Number	Average tpd per machine	Number	Average tpd per machine
Total paper	981	84	919	100
Newsprint	38	288	43	339
Uncoated groundwood	38	100	33	119
Coated papers	81	143	82	173
Uncoated free-sheet*	278	74	258	98
Thin papers	62	17	45	24
Solid bleached bristols	16	213	17	177
Packaging & ind. converting	228	80	205	75
Tissue	240	53	236	62

1. Because some machines can produce more than one grade, classifications are considered estimates

* Includes cotton fiber

Source: API capacity surveys

MARKET INDICATORS FOR PAPER GRADES: ADVERTISING INDEXES

(1967 = 100)

	General index	Television	Spot TV	Magazines	Newpapers
1981	344	383	379	284	323
1980	307	353	331	253	278
1979	274	312	293	235	246
1978	241	269	263	209	214
1977	210	238	223	174	198
1976	183	196	218	144	178
1975	146	158	164	118	144
1974	140	147	151	121	141
1973	130	135	139	116	131
1972	125	124	133	116	130
1971	112	109	116	110	117
1970	112	114	125	104	105
1965	90	85	90	93	93
1960	67	56	53	73	92

Source: Based on average monthly expenditures for those media giving national coverage. McCann-Erickson advertising index via Survey of Current Business, Bureau of Economic Analysis, Census

PRINTING/WRITING PAPER SHIPMENTS, 1981-82

(000 short tons)

Grade	1981e	1982e
Uncoated free-sheet total	7870	7907
Offset	1990	1981
Copy/duplicating (BMDX)	1911	1949
Forms bond	1569	1569
Envelope	854	863
Tablet	322	325
Text & cover	239	230
Other	985	990
Total coated paper	4947	5015
Coated one-side	440	430
Coated two-sides Nos. 1-4	1990	1930
Coated two-sides No. 5.	2517	2655
Operating rates		
Uncoated free-sheet	90%*	88%
Coated groundwood	91*	84
Coated free-sheet	94*	94

e = estimate

* Pulp & Paper Week estimates

Source: American Paper Institute, Champion International Corp.

MARKET INDICATORS, PRINTING & PUBLISHING PAPERS: VALUE OF SHIPMENTS

($ million)[1,2]

SIC code:	Newspapers 2711	Periodicals 2721	Book publishing 2731	Book printing 2732	Commercial printing 2751,2,4,	Manifold business forms 2761
Year						
1980e	17,750	9,229	6,675	2,325	19,700	4,308
1979e	16,125	8,240	6,040	2,100	18,200	3,846
1978e	14,500	7,292	5,495	1,920	16,500	3,259
1977	12,966	6,077	4,882	1,696	14,800	2,884
1976	11,659	5,044	3,968	1,328	13,355	2,328
1975	10,433	4,380	3,537	1,241	11,691	2,185
1974	9,568	4,059	3,349	1,127	10,864	2,305
1973	8,868	3,856	3,143	1,064	9,961	1,708
1972	8,270	3,521	2,857	938	9,111	1,430
1971	7,355	3,239	2,739	891	8,133	1,278
1970	6,967	3,096	2,434	800e	7,865	1,233

1. Value for industry, including service
2. Other printing categories, such as engraving and plate printing, greeting card publishing, blankbooks and looseleaf binders, bookbinding work, typesetting, photoengraving, electrotyping and platemaking services are not included but amounted to $8.0 billion in 1979

e Estimated

NEWSPRINT

GRADE STRUCTURE

Newsprint is manufactured primarily for regularly appearing sections of newspapers, along with such commercial printing end-uses as pre-printed newspaper inserts, which consume another 500,000 tpy of newsprint according to one estimate. Most of the furnish for newsprint manufacture is mechanical pulp, with chemical pulp being added to improve runability on the paper machine and printing press.

The standard basis weight for newsprint in the U.S. is 30 lb/3000 ft^2 or 48.8 g/m^2, but St. Regis Paper's Southland Div. makes newsprint at 28.5 lb (46.4 g/m^2) and some mills make paper up to 35 lb basis weight (56.9 g/m^2). Standard basis weight before 1974 was 32 lb (52.1 g/m^2) but this was reduced to 30 lb as a cost- and fiber-saving device. Some further reductions, possibly to an average of about 28.5 lb or even less, are possible, but significant reductions are not likely because of anticipated consumer resistance.

Slight variations in surface qualities of the sheet are introduced in order to conform to needs of the three major printing methods used by the newspaper industry. Letterpress printing is the favored method in the U.S. but offset printing has gained in popularity in recent years and now represents more than 25%—up from 19% in just two years. Rotogravure is still preferred for longer runs (for example, over 1 million copies). Rotogravure newsprint is priced about 13% higher than the other two grades of newsprint, and within each grade there are variations in basis weight, opacity and brightness.

Most newsprint is made on fourdrinier paper machines, although an increasing number of mills are switching to twin-wire machines when they add new units. Mills with existing fourdriniers in Canada and elsewhere have retrofitted those units with twin-wire formers (such as the Bel Baie former, Dynaformer, Papriformer or Verti-Forma), to improve sheet characteristics and add marginally to machine speed on fourdriniers that are drainage-limited. Speedup results because of faster drainage, while a twin-wire also produces paper with less two-sidedness, which is particularly attractive with offset grades. The changeover is relatively inexpensive, and at least one manufacturer claims it can be accomplished in as little as two days.

Most newsprint is not sized other than having alum added at the grinders to prevent resin buildup. With the high opacity of groundwood pulp, fillers are generally

STATISTICS FOR NEWSPRINT

	1980	1981	1982e
UNITED STATES			
Production, 000 short tons*	4,672	5,239	5,300
Capacity, 000 tons	4,826	5,334	5,583
Utilization rate, %	97	98	95%
Apparent U.S. consumption			
000 tons	11,120	11,200	11,200
lb/capita	99.9	99.6	99.9
000 tons/$ billion real GNP	7.50	7.43	7.43
CANADA			
Production, 000 short tons	9,507	9,650	9,354
Capacity, 000 tons	10,064	10,411	11,100
Utilization rate, %	94	93	84

e = Estimated
* All tons are short tons

Source: PULP & PAPER

not needed. Bleaching is with peroxides or hydrosulfites, giving a final brightness of about 55 or 60, in contrast with the 60 to 65 brightness range preferred for higher grades of uncoated groundwood paper such as directory.

Groundwood pulp makes up the bulk of furnish in most newsprint mills, while thermomechanical pulp has come into increasing usage—and in a few cases, such as F.F. Soucy Inc.'s Rivière-du-Loup, Que., facility, TMP is used exclusively. In many mills, TMP has been employed to replace some chemical pulp. Chemical pulp, with its longer fibers, typically makes up 10% to 15% of newsprint furnish in order to improve sheet strength, with unbleached softwood sulfite pulps widely used in Canada and semibleached sulfate softwood pulp preferred in the U.S. But TMP has greater strength than groundwood pulp—although still weaker than chemical pulp—while costing less than chemical pulp, and thus represents an economical partial replacement for sulfate or sulfite pulps.

Some mills also manufacture newsprint from deinked waste newspapers. Garden State Paper Co. operates two mills making newsprint entirely from deinked old newspapers: both mills are located in urban areas where plentiful supplies of wastepaper exist.

Other mills use deinked newsprint and mechanical pulp or TMP, while still others (such as F.F. Soucy) use TMP by itself. The mix of wastepaper and mechanical pulp varies widely from mill to mill, according to fiber availability and the specific cost structure of the mill. Bear Island Paper's Doswell, Va., mill is using 95% TMP with 5% chemical pulp. Southeast Paper in Dublin, Ga., uses 90% or more waste news in its furnish, with the balance thermomechanical pulp. Consolidated-Bathurst's new Bridgewater mill in U.K. will consume 30% deinked news, 5% bleached softwood kraft pulp and 65% TMP, when it starts up in late 1983.

INDUSTRY STRUCTURE

Canada is the home of the bulk of North American newsprint capacity, producing nearly 65% of the 14.9 million short tons of newsprint manufactured in North America in 1981. Approximately 68% of its output was shipped to the U.S., representing about 60% of U.S. consumption.

But in the last decade, the most rapid capacity expansion has occurred in the U.S. industry rather than in the Canadian industry. Between 1979 and 1982, U.S. capacity went up by 35.9%, while Canadian capacity was rising by only 11.1%. Between 1972 and 1982 U.S. capacity rose by 2.1 million short tons, compared with a Canadian capacity increase during that period of only 1.7 million short tons.

U.S. capacity is expected to continue a steady growth rate during the balance of the 1980s, although perhaps not quite as rapid as the rate of the 1970s, while Canadian capacity should begin to flatten out as more and more old Canadian machines are converted to produce uncoated groundwood papers, under competitive pressure from increasingly more profitable U.S. mills.

Due to the high capital cost of new mills, along with dwindling reserves of untapped forest land, Canadian capacity expansion in the future is likely to be concentrated in incremental expansions and additional machines at existing mills. However, the increased profitability of Canadian mills in the last few years—enjoying the exchange rate benefits of a falling Canadian dollar, with newsprint sold in the U.S. in U.S. dollars but produced in Canada in Canadian dollars—has led to a burst of Canadian capital spending in recent years.

Many Canadian newsprint machines date back to the 1920s and '30s, and most are two to three decades old. Despite rebuilds and speedups, these relatively inefficient machines often cannot compete with modern fourdrinier and twin-wire paper machines. Also, U.S. mills have a fiber cost advantage, with U.S. southern mills—close to the fastest-growing newspaper markets

U.S. NEWSPRINT CAPACITY AND PRODUCTION

(000 short tons)

Year	Capacity	Production	Operating rate
30-lb weight			
1984	5907	—	—
1983	5710	—	—
1982	5583	—	—
1981	5334	5239	98%
1980	4836	4672	97
1979	4109	4062	99
1978	4104	3768	92
1977	4069	3871	95
1976	4014	3736	94
1975	3948	3691	92
1974	3722	3561	93
32-lb weight			
1974*	3889	3690	93
1973	3819	3738	96
1972	3694	3656	98
1971	3642	3476	95
1970	3533	3464	98
1969	3374	3362	100
1968	3176	3045	96
1967	2844	2709	95
1966	2545	2483	98
1965	2372	2245	95

* Adjusted to 32-lb equivalent basis weight

Source: Canadian Pulp & Paper Assn. and American Paper Institute

ESTIMATED ANNUAL NEWSPRINT CAPACITY OF MAJOR COMPANIES

(000 short tons)

	Canada	U.S.	Total	Capacity share (%)
1. Abitibi-Price Inc.	1952	238[1]	2190	13.1%
2. Bowater Inc.	577	878[2]	1455	8.7
3. CIP Inc.[3]	1133	—	1133	6.8
4. Consolidated-Bathurst	1050[4]	—	1050	6.3
5. MacMillan Bloedel	990	—	990	5.9
6. St. Regis Paper Co.	—	850[5]	850	5.1
7. Boise Cascade	249	461[6]	710	4.3
8. Ontario Paper	710	—	710	4.3
9. Kimberly-Clark	350[7]	339	688	4.1
10. Publishers Paper	—	575	575	3.4
11. Crown Zellerbach	430	140	570	3.4
12. Kruger Inc.	526	—	526	3.2
13. B.C. Forest Products	480	—	480	2.9
14. Great Lakes Forest Products[3]	443	—	443	2.7
15. North Pacific Paper[8]	—	440	440	2.6
16. Donohue	360[9]	—	360	2.2
17. Reed	360	—	360	2.2
18. Garden State		335	335	2.0
19. International Paper	—	300	300	1.8
20. Great Northern	—	292	292	1.8
21. Southwest Forest	—	275	275	1.6
22. Domtar	270	—	270	1.6
23. F.F. Soucy	192	—	192	1.2
24. Bear Island	—	179	179	1.1
25. James Maclaren Co.[10]	176	—	176	1.1

TOTAL NORTH AMERICAN CAPACITY (1982): 16.683 million tons
CAPACITY SHARE OF TOP FIVE COMPANIES: 40.5%
CAPACITY SHARE OF TOP TEN COMPANIES: 62.0% (unchanged)

1. Includes 77,000 tpy from Boise Southern, DeRidder, La.; balance assigned to Boise Cascade.
2. Includes 226,000 tons from Catawba Newsprint (51% owned); also 653,000 tons from Calhoun, Tenn.
3. Subsidiary of Canadian Pacific Enterprises Ltd.
4. Excludes No. 3 paper machine at Wayagamack div. mill, shut down indefinitely in 1982.
5. Southland div.
6. Includes 278,000 tons at Boise Southern Co.; balance of tonnage assigned to Abitibi-Price.
7. Includes production at Spruce Falls Power & Paper Co. (50.5% owned).
8. Subsidiary of Weyerhaeuser Co. and Jujo Paper Co. Ltd.
9. Includes tonnage at Donohue Charlevoix Inc. and Donohue Malbaie Inc., plus 93,000 tons of capacity from 185,000 tpy Amos, Que. (Donohue Normick) mill which started up in 1982.
10. Subsidiary of Noranda Mines. Ltd.

in the U.S.—enjoying wood costs that are more than a third lower than those of eastern Canadian mills. And, being located closer to those markets, U.S. mills benefit from a transportation cost advantage, although that advantage is partially offset by typically higher financing costs in the relatively newer U.S. mills.

Netted of currency differentials, U.S. mills thus make more money per ton of product than do Canadian mills, and should the Canadian dollar once again approach its traditional approximate parity with the U.S. dollar, most observers agree a substantial portion of the Canadian industry would find its profits would fall sharply or disappear entirely. This is one of the factors behind an increasing shift to uncoated groundwood production, which one executive believes could reduce Canadian newsprint capacity by a million tons by the middle of the decade.

Another factor hurting the Canadian industry in the last 10 to 15 years has been the perception in the minds of the U.S. newspaper publisher that Canadian suppliers are less reliable than U.S. mills. The major factor in this perception is the frequency and length of Canadian mill strikes, which tend to shut down much of the Canadian industry at a time because of region-wide bargaining—while U.S. mills bargain on a mill-by-mill basis, or in small groupings of mills.

Also, until the last few years, Canadian mill profiitability was not sufficient to justify capacity expansions that would meet customer needs: customers of British Columbia mills were still on delivery-limiting allocations going into the early 1980s. Publishers in several locations of the U.S. reacted by uniting to build mills that they could rely on, essentially competing with their former suppliers. U.S. publishers became increasingly wary of long-term contracts with Canadian mills.

All of these trends, plus high Canadian labor costs and uncertain provincial and federal policies on foreign investment in Canada, discouraged some Canadian companies from adding capacity, although the currency exchange shift in Canada's favor finally induced a number of Canadian mills to begin planning new machines. Unfortunately, this happened as the U.S. was on a capacity-expansion binge, with the result that by 1982—a recession year, to boot—there was believed to be a capacity surplus in North America in excess of 2 million tpy. By one estimate, there are 2 million tpy of capacity in Canada alone represented by old-fashioned open-draw machines of less than 200 tpd—possibly prime candidates for shutdown.

Much of the new U.S. capacity was positioned in regions where Canadian mills cannot compete economically with the added U.S. machines: the southern states have been a focus of expansion by U.S. mills—and Abitibi-Price reacted by shifting a large portion of its budget for capacity expansion to its Augusta, Ga., mill.

Indeed, in the southern and western states, Canadian mills lost market share in the 1970s, according to a study for the American Newspaper Publishers Assn. by Dr. Jon Udell. The Udell study showed that between 1969 and 1979, Canadian shipments to the South rose by 17.2% while total shipments to that region were going up 31.2%—and shipments from U.S. mills, especially the South itself, were shooting up 46.0%. U.S. mills captured 66.6% of the southern market in 1979, up from 59.8% in 1969, while Canada slipped from 36.4% to 32.5%.

In the West the picture was less dramatic, partly because eastern Canadian mills saw their market share in the West jump from less than 1% to 7.2%. But even in that region, the U.S. market share rose to 49.9% from 48.2%, while the Canadian share dropped to 44.8% from 50.7%.

Only in the North Central region did U.S. market share fall—to 15.2% from 17.2%. In the Northeast, both U.S. and Canada gained market share slightly, at the expense of overseas imports.

While Canadian mills were gaining in market share in the Northeast and North Central states, however, circulations of daily newspapers in those regions were shrinking—by 9.1% and 0.7% respectively—giving Canada a bigger piece of a smaller pie. By contrast, circulations of daily papers in the South were jumping by 31.2% and those in the West by 27.6%.

That 1969-79 period also showed a shift toward newspapers in the small and medium-sized cities that dominate the Sunbelt, while the big city papers of the nation were losing circulation. Daily circulation in cities of less than 100,000 population rose by 17.1%, while circulation in cities of 500,000 or greater fell by 14.4%. If those demographic trends continue, it points to an even further erosion of Canadian market share in the market that makes or breaks the Canadian newsprint industry.

OUTLOOK

Newsprint mills in both the U.S. and Canada faced a slowdown in 1982, with operating rates of 95% or below likely for the U.S. and 82% to 85% predicted for Canada. The medium-term prospect, however, is for continued strength in U.S. operating rates and a slow recovery in the Canadian utilization rate—especially if a few Canadian mills don't survive the short term.

Publishers built up inventories during the second half of 1981 and the first quarter of 1982, and by the start of 1982's second period, consumer stocks in the U.S. had reached 1.7 million metric tons—a 400,000-ton increase from the same point of 1981. The 1.7 million-ton level represented about 57 days of supply at March 1982 consumption rates, and that 57 day-level seemed to be the peak for that inventory-building cycle.

With eastern Canadian labor contracts expiring in the second quarter of 1982, publishers were expected to begin paring stocks back during the second half to about 1.4 million or 1.5 million tons. Thus the newsprint industry would not experience the inventory rebuilding that characteristically aids many industries during the recovery period of a recession year such as

NET NORTH AMERICAN NEWSPRINT CAPACITY CHANGES

(through 1985)

Announced projects	**Location**	**Net change** (000 short tpy)	**Startup**
Abitibi-Price[1]	Iroquois Falls	—	1982
B.C. Forest Products	Crofton, B.C.	193	1982
CPI Inc. [2]	Dalhousie, N.B.	110	1982
Consolidated-Bathurst[2]	Shawinigan, Que.	44	1982
Crown Zellerbach	Campbell River, B.C.	193	1982
Donohue Normick	Amos, Que	175	1982
Ontario Paper[1]	Thorold, Ont.	14	1982
Southwest Forest[3]	Snowflake, Ariz.	120	1982
Abitibi-Price [4]	Beaupre, Que.	−140	1983
Abitibi-Price/Augusta Newsprint	Augusta, Ga	120	1983
Consolidated-Bathhurst[2]	Ville de La Baie, Que	80	1984
Rexfor/F.F. Soucy	Matane, Que	176	1984
Boise Cascade[2]	Kenora, Ont.	33	1985
B.C. Forest Products	Hurdy, Alta.	193	1985
Under study			
Abitibi-Price[1]	Grand Falls, Nfld.	25	1984
Abitibi-Price[1]	Alma, Que.	33	1984-5
Abitibi-Price	Iroquois Falls, Que.	190	1985-6
Great Lakes Forest Products	Dryden, Ont	193	n.a.
Great Lakes Forest Products[2]	Thunder Bay, Ont.	n.a.	n.a.
Publishers Paper	Oregon City, Ore.	n.a.	n.a.
Southeast Paper	Dublin, Ga.	160	n.a.
Southern Newsprint Enterprises	Grenada or Batesville, Miss	200	n.a.
Stora/Canal	Conway, S.C.	n.a.	n.a.
Sunbelt Forest Products	Boligee, Ala	210	n.a.
Wilbert Associates	Globe, Ariz.	175	n.a.

n.a. = not available

1. New machine(s) plus shutdown of existing machine(s)
2. Incremental expansion of existing machine(s)
3. Conversion from linerboard
4. Conversion to uncoated groundwood

Source: Pulp & Paper Project Report; Pulp & Paper Week

1981 NEWSPRINT EXPORTS FROM MAJOR PRODUCING COUNTRIES

NEWSPRINT EXPORTS FROM MAJOR PRODUCING COUNTRIES

(000 metric tons)

Importer			**Exporter**		
EUROPE	**USA**	**Canada**	**Sweden**	**Finland**	**Norway**
Belgium	—	15	21	27	25
Denmark	—	—	75	69	31
France	—	8	106	153	54
Germany, Fed. Rep.	—	93	283	167	119
Greece	—	—	8	31	7
Ireland	—	9	16	14	20
Italy	—	—	26	19	10
Netherlands	—	50	129	44	62
Portugal	—	—	15	11	8
Spain	—	12	27	31	16
Sweden	—	1	—	—	5
United Kingdom	2	554	221	413	98
Other	1	—	12	74	6
Total Europe	**3**	**742**	**937**	**1,055**	**461**
NORTH AMERICA					
Canada	8	—	—	—	na
United States	—	6,166	25	7	na
Total North America	**8**	**6,166**	**25**	**7**	**17**
ASIA & AUSTRALIA					
Australia	—	103	6	110	1
China	—	77	37	19	5
Hong Kong	—	18	8	1	—
India	3	143	31	55	14
Indonesia	6	11	21	5	2
Iran	—	—	1	20	—
Japan	115	29	—	—	—
Malaysia	—	31	3	2	—
Singapore	—	19	—	—	—
Taiwan	—	23	—	—	—
Thailand	—	5	40	10	18
Other	2	6	67	80	29
Total Asia/Australasia	**126**	**465**	**214**	**302**	**69**
LATIN AMERICA					
Argentina	1	20	18	23	—
Brazil	—	96	18	19	—
Colombia	2	87	—	10	—
Costa Rica	—	8	—	—	—
Dominican Rep.	—	14	—	—	—
Ecuador	—	33	—	—	—
El Salvador	—	13	—	—	—
Guatemala	1	6	—	—	—
Mexico	60	106	25	35	—
Peru	—	15	—	—	—
Puerto Rico	—	44	—	—	—
Trinidad & Tobago	—	11	—	—	—
Venezuela	26	117	7	6	—
Other	15	33	2	7	4
Total Latin America	**106**	**603**	**70**	**100**	**4**
AFRICA					
Egypt	—	—	10	64	—
Nigeria	2	—	13	7	—
Other	—	3	32	7	16
Total Africa	**2**	**3**	**55**	**78**	**16**
WORLD TOTAL	**245**	**7,979**	**1,301**	**1,542**	**573**

Source: PULP & PAPER INTERNATIONAL, annual review 1982

1982. In fact, most economists expect U.S. newsprint demand to track U.S. gross national product growth, and this slow growth means that the only rapid increase in sales any mill will experience will be at the expense of competing suppliers.

Mills in western North America may face a particularly rough battle for market share heading into the mid-1980s, with about 870,000 short tpy of capacity coming on-line in western U.S. and British Columbia between 1980 and 1982 alone—a 33% increase in capacity in a period when consumption was showing very little real increase at all, and in a region that only consumed 2.5 million short tons in 1980.

Dr. Jon Udell projected for the American Newspaper Publishers Assn. that total U.S. newsprint consumption will reach 12.5 million short tons by 1985, rising by about 3%/year during the intervening period. Consumption could top 13 million tons if the U.S. GNP grows as rapidly as 3.5%/year, but Udell concedes it is possible demand could grow to only 12.3 million tons at the middle of the decade.

Most observers expect that Canadian consumption will reach only about 1.3 million short tons in 1985,

U.S. PRICES FOR NEWSPRINT

($/short ton)

1982	
2nd quarter	$453
1st quarter	453
Year-end	
1981	453
1980	400/426
1979*	375
1978	320
1977	300
1976	285
1975	258
1974	229
1973	182
1972	164
1971	158
1970	150

* Data for 1979-70 from P&P WEEK DATABOOK 1980

U.S. CONSUMPTION OF NEWSPRINT

(000 short tons)

		Shipments from:			
Year	**Consumption**	**U.S.A.**	**Canada**	**Europe**	**Consumer[1] stocks**
30-lb weight					
1981	11,205	4,907	6,682	41	1,628
1980	11,120	4,473	6,744	138	1,202
1979	11,240	3,970	7,023	146	967
1978	10,872	3,674	7.102	0	1,070
1977	10,232	3,737	6,341	0	1,181
1976	9,611	3,632	6,251	57	1,333
1975	9,254	3,566	5,489	33	1,004
1974	10,284	3,457	6,949	213	1,170
32-lb weight					
1974*	10,685	3,582	7,239	213	1,248
1973	10,794	3,657	6,855	381	782
1972	10,547	3,549	6,430	328	784
1971	9,835	3,307	6,146	317	1,041
1970	9,706	3,316	6,163	314	1,110
1969	9,855	3,246	6,431	293	1,017
1968	9,327	2,944	6,107	284	894
1967	9,238	2,612	6,263	283	885

1. Based on data from American Newspaper Publishers Assn.
* Adjusted to 32-lb equivalent basis weight

Source: Canadian Pulp & Paper Assn.

CANADIAN CAPACITY, PRODUCTION AND SHIPMENTS OF NEWSPRINT

(000 short tons)

Year	Capacity[1]	Production	Operating rate	Change in capacity	Change in production	Shipments
30-lb weight						
1983e	11,574	—	—	—	—	—
1982e	11,100	—	—	—	—	—
1981	10,411	9,861	96	347	354	9,829
1980	10,064	9,507	94	77	−144	9,504
1979	9,987	9,651	97	126	−62	9,677
1978	9,861	9,713	98	−41	725	9,792
1977	9,902	8,988	91	−19	73	9,005
1976	9,921	8,915	90	29	1,236	8,712
1975	9,892	7,697	78	—	−1,869	7,728
1974	10,038	9,548	95	—	—	9,597
32-lb weight						
1974[3]	10,474	9,946	95%	137	806	9,998
1973	10,337	9,140	88	37	320	9,199
1972	10,300	8,820	86	60	365	8,901
1971	10,240	8,455	83	395	−264	8,362
1970	9,845	8,719	89	170	−99	8,704
1969	9,675	8,818	91	20	787	8,797
1968	9,655	8,031	83	361	−20	8,096
1967	9,294	8,051	87	416	−368	7,968
1966	8,878	8,419	95	457	699	8,385
1965	8,421	7,720	92	147	419	7,747

Strike loss in 1979: 3% of capacity
Strike loss in 1976: 7% of capacity
Strike loss in 1975: 19% of capacity
Strike loss in 1973: 6% of capacity

1. Tonnage data for 1965-74 are based on 32-lb weight newsprint; those for 1974-77 are measured in terms of 30-lb basis weight
2. P&P estimate
3. Adjusted to 32-lb equivalent basis weight

Source: Canadian Pulp & Paper Assn.

which—combined with loss of market share in the U.S. and presently planned North American capacity increases during the first half of the decade—means Canadian mills will have to seek significantly increased overseas markets to keep busy.

- **Overseas markets.** Canada has long had a prominent position in Latin America, although that relationship in some portions of the continent could be affected in small ways by the 1982 Canadian trade embargo against Argentina—in which Canada ceased its 20,000-tpy export trade in newsprint with that country for the duration of the conflict between Argentina and Great Britain—if Latin Americans perceive Canadian supply as subject to political whims. But Canada's overall ability to exploit the fast-growing Latin American market is excellent, with Mexico, Venezuela, Argentina and Brazil particularly exciting prospects. Some U.S. mills export to those countries as well.

Asia and Africa have also represented a growth area for North American exports in recent years, with Canadian shipments to those continents and Oceania jumping from 314,000 short tons in 1975, according to Canadian Pulp & Paper Assn., to 422,000 tons in 1980. Aside from Japan, India is the biggest market in those regions, consuming 353,000 short tons in 1980—276,000 tons of that imported. However, with four machines representing a total of nearly 400,000 tpy of

AVERAGE COSTS OF PRODUCING NEWPRINT[1]

(U.S.$/short ton)

	CANADA				U.S.A.			
	British Columbia		Eastern		South		Northwest	
	$/ton	%	$/ton	%	$/ton	%	$/ton	%
Wood	$ 97	27.1%	$102	29.1%	$ 75	22.3%	$116	30.5%
Energy	41	11.5	44	12.6	82	24.4	64	16.8
Chemicals	11	3.1	10	2.9	16	4.8	16	4.2
Materials[2]	38	10.6	30	8.6	38	11.3	37	9.7
Labor	68	19.0	63	18.0	51	15.2	60	15.8
Transportation	45	12.6	49	14.0	18	5.4	37	9.7
Administration	38	10.6	40	11.4	29	8.6	21	5.5
Depreciation	19	5.3	12	3.4	27	8.0	29	7.6
TOTAL	$357		$350		$336		$380	

1. Estimated 1981 costs
2. About evenly split between maintenance materials and operating supplies

Source: P&P estimates

SHARE OF ADVERTISING REVENUE RECEIVED BY NEWSPAPERS AND MAGAZINES

	1981		1978		1970		1960	
	$ million	%	$ million	%	$ million	%	$ million	%
Daily newspaper	17,420	28.4	12,690	29.0	5,745	29.3	3,703	31.0
Magazines	3,533	5.8	2,595	5.9	1,323	6.8	941	7.9
Television	12,650	20.6	8,850	20.2	3,665	18.7	1,590	13.3
Radio	4,212	6.9	2,955	6.8	1,278	6.5	692	5.8
Direct mail	8,781	14.3	6.030	13.8	2,734	13.9	1,803	15.1
Business publications	1,841	3.0	1,420	3.2	740	3.8	609	5.1
Outdoor	650	1.1	465	1.1	234	1.2	203	1.7
Others	12,087	19.7	8,735	20.0	3,881	19.8	2,365	19.8
Total	61,320		43,740		19,600		11,932	

Source: McCann-Erickson Inc.

capacity scheduled to start up in the 1982-84 period, India may switch from a net importer to net exporter if current expansion plans are realized.

Japan is a healthy market for newsprint imports. But with substantial excess capacity of its own, Japan bought less from traditional Canadian suppliers than usual during the 1981-82 recession period, and its future relationship to overseas suppliers remains to be seen.

The most important overseas market is still Western Europe, where Canada shipped nearly 690,000 short tons in 1980, according to CPPA. But possible entry of some of the Scandinavian countries into the European Community may affect the ease of entry of North American products into the important EC market. Concern over that possibility led Consolidated-Bathurst Inc. to take the innovative although risky step of buying Bowater Corp.'s idled 200,000-short-tpy mill in Ellesmere Port, U.K., with plans to expand capacity by 36% and supply it with thermomechanical pulp from Con-Bath's Bathurst, N.B., mill—all in order to gain a European position for selling newsprint inside the EC tariff wall.

- **Home news services.** Canadian and U.S. mills alike face a long-term concern if they plan to add any new capacity beyond what is currently in place or planned. American Telephone & Telegraph predicts 7% of U.S. homes in 1990 will have video equipment capable of receiving home information services such as an electronic Yellow Pages, electronic classified advertising, news and various transactions services (shopping, banking, travel arrangements, etc.). If that prediction begins to come true, paper mill capacity built in the early 1980s and depreciated over a 10-year period will find its economic lifetime butting into competition from non-paper-based information transmission systems. Capacity added in the mid-1980s and beyond may find itself in a surplus position by the mid-1990s.

Reliable estimates do not exist for the likely timing and dimensions of a significant home information network that could affect paper demand, and a sizable body of opinion holds that the paper industry will not feel the competition of the electronic media to a great extent before the new century. On the other hand, estimates from sources like International Resources Development Inc. and Arthur D. Little have indicated a substantial impact on the newsprint industry by the early 1990s, and IRD even pointed to a possible flattening out of U.S. newsprint demand by the late 1980s.

Most scenarios that do call for substantial impact on the industry by the early 1990s posit some kind of consumer service that penetrates the home first—electronic toys and games and cable television networks are two commonly-cited examples—with information services such as classified and directory advertising piggybacked on top of such attractive services. There is an outside possibility, however, that AT&T by itself could begin a program to replace paper directories with electronic equipment, just as France's telephone company is doing.

Once hardware—including a modem, or telephone line hookup—is in place, information services such as rapidly updated classified advertising will prove relatively cheap. And once classified advertising—representing nearly 30% of all newspaper advertising revenues—can more conveniently be delivered to the home electronically than by paper, the economic

NORTH AMERICAN NEWSPRINT INVENTORY TRENDS

(000 metric tons)

Year	Consumption (U.S.)	Year-end stocks held by all U.S. consumers	Days of supply held at year's end by U.S. consumers	Year-end stocks held by all mills in North America
1981	10,164	1,477	56	232
1980	10,088	1,090	42	186
1979	10,199	877	34	178
1978	9,877	970	38	204
1977	9,280	1,071	43	287
1976	8,719	1,209	52	297
1975	8,395	911	44	105
1974	9,329	1,061	48	151
1973	9,400	757	32	197
1972	9,018	667	26	252
1971	8,364	885	38	338

Source: Canadian Pulp & Paper Assn.

viability of the newspaper industry will begin to weaken. At that point, the common scenario runs, newspapers will begin to restructure their news and advertising services to minimize costs and take advantage of the new medium, and newsprint demand will stagnate.

One blow to the future strength of print-media advertising came in 1982 when the first prototype video display terminals with high-quality graphics began to appear. If terminal manufacturers can overcome the other major objection of consumers to extended use of screens—eyestrain—electronic purveyors of information would be halfway to the position where they can invade the market for home news as well as advertising.

Skeptics point out the high cost of such equipment and the preference of most consumers for the highly convenient and portable daily newspaper. They also note that few proposals for home entertainment or information services seem likely to generate the mass market that would really threaten the print media, invading instead only the upper-middle-class segment of the population that can afford such expensive toys. Whether the skeptics or the dreamers are right remains to be seen, but one thing seems clear from recent attendance at seminars and sales of studies on such topics: the paper industry is alert to the potential dangers represented by the newest electronic media.

U.S. NEWSPRINT DEMAND TRENDS BY REGION

(000 metric tons)

Region	**1969**	**1979**	**% change 1969-79**	**1981**	**% change 1979-81**
Northeast	2035	1850	−9.1	1881	1.7
Midwest	1928	1915	−0.7	1788	−-6.6
South	1755	2302	31.2	2475	7.5
West	1335	1704	27.6	1763	3.5

Source: "The Future of U.S. Newspapers and Newsprint Consumption," by Dr. Jon Udell, for American Newspaper Publishers Assn.; and ANPA figures.

RESEARCH: KENAF EFFORTS FINALLY SHOW PROMISE

Paper industry researchers for some years have been intrigued by the possibilities represented by a weed called kenaf, a distant relative of the hemp plant that has been used to make rope and that appears in an illegal form as marijuana. The possibilities that interest the paper industry involve its potential use as a fiber for papermaking, and it finally appears that those possibilities may soon be realized.

Newsprint has been the particular focus of kenaf research. Raw material costs as well as energy and labor expenses could be cut and newsprint capacity raised if mills used kenaf for pulping, according to a feasibility study done by Soil & Land Use Technology Inc., for the American Newspaper Publishers Assn.

Results of the 170-page study, released in the first half of 1982, indicate that the tall (up to 20 ft) plant can be grown and used for pulping in areas of the southern U.S. where more than 50% of U.S. newsprint capacity is located. This study focused on 13 newsprint mills in that area.

The research indicates kenaf can be combined with chemical pulps such as soda and kraft to produce superior strength and freeness level similar to commercial hardwood pulps, and, except for resistance to tear, is comparable to softwood pulp. Blends of bleached kenaf thermomechanical pulp and 10% to 15% kenaf soda pulp were determined to have strength values similar to those required in commercial newsprint, the research indicated.

In a test study of kenaf pulping at International Paper Co.'s newsprint mills in Mobile, Ala., and Pine Bluff Ark., results were encouraging. Kenaf newsprint made from a chemithermomechanical pulping process had lower opacity but more strength and comparable brightness to regular newsprint.

Kenaf can be used at mills with TMP or kraft pulping processes with only minor adjustments. Conventional mechanical pulping processes can also be modified to use kenaf, although the transition is more complicated. Recycled newsprint mills, however, would need

WORLD CAPACITY FOR NEWSPRINT

(000 short tons)

Year	Canada	U.S.A.	Western Europe	Asia and Oceania	Eastern Europe	Africa & L. America	Total
1981p	10,411	5,334	7,096	5,194	2,651	1,095	31,780
1980	10,064	4,826	6,987	4,858	2,596	1,017	30,349
1979	9,990	4,199	6,890	4,622	2,431	939	29,071
1978	9,901	4,090	6,534	4,592	2,309	780	28,207
1977	9,902	4,069	6,257	4,404	2,177	755	27,563
1976	9,921	4,014	6,395	4,136	2,090	679	26,852
1975	9,892	3,948	6,145	3,960	2,090	616	26,265
1974	10,038	3,722	6,246	3,829	1,964	595	26,009
1973	10,337	3,819	6,505	3,223	1,974	592	26,450
1972	10,300	3,694	6,366	3,187	1,866	509	25,922
1971	10,240	3,642	6,408	2,925	1,864	465	25,543
1970	9,845	3,533	6,465	2,989	1,863	469	25,164

p Preliminary

Source: Canadian Pulp & Paper Assn., Newsprint Data

WORLD DEMAND FOR NEWSPRINT

(000 short tons)

Year	North America	Western Europe	Asia and Oceania	Eastern Europe	Africa & L. America	Total
1980p	12,434*	6,229	5,747	1,970	1,856	28,237
1979p	12,210*	6,036	5,452	1,943	1,711	31,762
1978	11,795	5,689	5,244	1,941	1,541	26,209
1977	10,986	5,463	4,802	1,889	1,669	24,808
1976	10,826	5,613	4,544	1,867	1,379	24,229
1975	9,952	5,550	3,887	1,812	1,373	22,574
1974	11,505	6,197	4,048	1,778	1,497	25,025
1973	11,752	6,059	3,799	1,689	1,393	24,692
1972	11,088	5,622	3,735	1,663	1,427	23,535
1971	10,491	5,488	3,597	1,617	1,416	22,609
1970	10,510	5,808	3,498	1,563	1,597	22,976
1969	10,679	5,636	3,261	1,474	1,430	22,480
1968	10,009	5,019	2,860	1,393	1,305	20,586
1967	9,796	4,654	2,596	1,323	1,195	19,564
1966	9,918	4,871	2,289	1,207	1,086	19,371

p Preliminary
* Actual

Source: Canadian Pulp & Paper Assn., Newsprint Data additional equipment to switch to making kenaf pulp.

Estimates of the cost of kenaf delivered to the mill range from $30 to $43/short ton for baled kenaf and $29 to $77/short ton for cubed kenaf. Most observers contacted for the study felt kenaf would initially be priced close to woodchips, but over the next few years the cost of kenaf should become more competitive as wood supplies deplete and costs rise.

Wood stumpage prices are expected to increase at an annual rate of 3.3% during the 1980s, according to the study, and 2.5%/year from 1990 to 2030.

Kenaf could be used in 25% of all U.S. newsprint production by 1985 if mills located in the southern U.S. were to expand capacity. It is more likely, however, that kenaf would be used in 11% to 16% of U.S. newsprint production by 1985, the report concludes.

- **Lumen-loading.** Another new technique also shows promise for newsprint mills, according to scientists at the Pulp & Paper Research Institute of Canada. Called "lumen-loading," it involves adding filler to the lumen, or hollow core, of the wood fiber.

The process appears to produce a sheet with the strength of standard newsprint but the brightness and opacity gains that traditionally result when fillers are added to paper.

PPRIC's A.M. Scallan cautions, however, that while the process shows promise for newsprint manufacturing, it is still in the laboratory stages of development.

When the lumens are loaded with filler, the surfaces of the fibers are left free of filler particles. Titanium dioxide is being used as the filler in PPRIC experiments, but Scallan speculated that in actual production it ought to be possible to use a less expensive filler.

One possible consequence might be a slight reduction in basis weight, partly because while traditional methods of adding fillers in the papermaking process may interfere with fiber bonding, filler loaded in the hollow core of fibers avoids that problem. The result is a stronger sheet.

"In addition to being stronger than a sheet conventionally filled to the same level, paper made from lumen-loaded fibers may be expected to exhibit no 'two-sidedness' in filler distribution and no tendency of filler to 'dust off' the sheet," Scallan explained.

"The superior retention of filler may also be expected to lead to better control of paper properties and to cleaner paper machine and printing press operations," he added.

UNCOATED GROUNDWOOD

GRADE STRUCTURE

Uncoated groundwood papers are similar to newsprint in terms of physical properties but are manufactured to have better printing characteristics and are priced above standard newsprint. They are used mainly as an intermediate printing paper between newsprint and coated paper, with the exception of the small (250,000 tpy) groundwood forms paper sector which competes with uncoated free-sheet forms bond.

Brightness is one distinguishing characteristic between uncoated groundwood sheets and competing products. Newsprint brightness ranges from 56 to 62 Elrepho, whereas uncoated groundwood grades start at about 64 and may go as high as 68, or even 70 in the case of products such as the supercalendered (SC) grade. These ratings are below those of coated groundwood, which are in the low to medium 70s, and uncoated groundwood is considered to be below coated groundwood in overall printing qualities. It does offer better endurance and a better printing surface than newsprint, however.

Most uncoated groundwood machines originally made newsprint and then were upgraded to production of groundwood specialties when they ceased to be economical competitors in the newsprint industry. Methods of upgrading a newsprint machine's output to uncoated groundwood include the addition of fillers, use of more chemical furnish and additional on-machine calendering, or supercalendering off-machine.

Several Canadian newsprint manufacturers are in the process of ordering or are considering ordering supercalenders for newsprint machines in order to produce SC papers of various qualities to compete with a recent surge in SC paper capacity in North America and Europe. One U.S. SC mill makes a rotonews sheet which gets clay content from the broke from an adjacent SC machine. Other methods of making uncoated groundwood papers that meet demands of specific end-use markets vary so widely that observers say the industry is becoming increasingly fragmented, which a few observers believe could eventually hurt product identity and pricing structures, and thus the ability of some mills to compete.

Typical end-uses for uncoated groundwood, with approximate U.S. demand estimates for uncoated groundwood (official statistics are not published), are: catalog, 400,000 tpy of uncoated groundwood; directory, 500,000 tpy; newspaper insert and direct mail advertising circular, 500,000 tpy; periodical (magazine and Sunday supplement), 1.0 million tpy; some business

STATISTICS FOR UNCOATED GROUNDWOOD PAPER*

	1980	1981	1982e
UNITED STATES			
Production, 000 tons	1498	1441	1412
Capacity, 000 tons	1624	1658	1774
Utilization rate, %	92.2	86.9	79.6
Imports, 000 tons	688	650	610
Exports, 000 tons	101	120	138
Apparent U.S. consumption			
000 tons	2085	1971	1884
lb/capita	18.73	17.54	16.59
000 tons/$ billion real GNP (1972)	1.41	1.31	1.26
CANADA			
Production, 000 tons	677	711	675
Capacity, 000 tons	728	799	865
Exports, 000 tons	570	577	540

* All tons are short tons
e Estimate

papers, 250,000 tpy; and miscellaneous end-uses including books, basestock for converting into various products and export, in excess of 200,000 tpy. Basis weight range is normally 18 to 40 lb (24x36 in., 500 sheets) or 30 to 66 g/m^2.

Catalog paper is consumed by major retailers such as Sears, Roebuck & Co., J.C. Penney and Montgomery Ward, along with a host of specialty stores, mail-order houses and other merchandisers. A Strategic Futures Inc. study estimated that 283,000 tpy of all kinds of papers are used by the major catalog merchandisers—primarily Sears, Penneys, Wards, Spiegel and Aldens—to produce catalogs, with another 321,000 tpy going to specialty catalog mail-order firms and 322,000 tpy going to retail merchandisers. Out of the total U.S. catalog market of 1.435 million tpy, SFI estimated 27% is uncoated, 41% is coated No. 5 and 32% is coated Nos. 3 and 4.

Catalog paper is made for rotogravure printing and for offset printing, with gravure printing favored for longer runs because of its economic advantages. Catalog paper is generally of higher quality than directory paper; in fact quality is a sufficiently significant consideration that a large number of catalog publishers have introduced some lightweight coated paper into their publications to enhance appearance. Traditional catalog paper has also suffered from competition from SC paper—again, for reasons of enhanced appearance.

Directory paper, such as telephone directory stock, has a lower gloss and brightness than catalog paper, and for telephone books is generally made in the 22 to 23 lb basis weight range. American Telephone & Telegraph is believed to consume upwards of 350,000 tpy of all directory paper used in the U.S. and General Telephone another 65,000 tpy, with other phone companies and other directory producers using the balance.

The newest force in uncoated groundwood markets has been supercalendered paper, either in the "SC magazine paper" range occupied by the major SC producers—Madison Paper Industries (with 165,000 tpy of capacity devoted to SC paper), St. Regis (with about 120,000 tpy) and CIP Inc. (about 70,000 tpy at Trois Rivières, Que.)—or in the "SC newsprint" area occupied by an increasing number of newsprint machines getting supercalenders to produce slightly upgraded newsprint paper. The term "SC magazine paper" is sometimes used to indicate a sheet that would be used in Europe for magazines or in North America for an increasing number of Sunday newspaper supplement magazines because it has an apparent surface similar to coated No. 5 papers, while the SC newsprint sheet is a lower quality product.

SC papers have been used extensively in Europe for years in magazines, and St. Regis and CIP have had some success over the years in selling SC magazine paper to Sunday supplements such as *Parade* or *Family Weekly*. *The New York Times* has bought 30,000 tpy from Finnish mills for several years for its Sunday supplement but now that Madison has brought a 165,000 tpy machine on-line—in a mill partly owned by the *Times*—the weekend publication will get half its SC paper needs from the new machine.

Aside from the supercalendering operation, SC papers have a clay filler content of 10% to 25% to enhance the appearance. This wide latitude on the part of a mill leaves a lot of room for gradations in the market. In fact, in the entire uncoated groundwood market, mills have been switching capacity to uncoated groundwood from other products at a rapid rate, and the wide

UNCOATED GROUNDWOOD PAPERS TYPICAL GRADE STRUCTURE

Grade	Basis weight[1]
Rotogravure[2] (standard, premium, high brightness)	33, 35 lb (25 x 38 in., 500 sheets)
Offset[2] (premium, high brightness)	28, 35, 38 45 lb (25 x 38 in., 500 sheets)
Magazine (gravure, offset)	35 lb. (25 x 38 in., 500 sheets)
Paperback/book	35, 37 lb. (25 x 38 in., 500 sheets)
Directory (white, yellow)	20, 22.5 lb. (24 x 36 in., 500 sheets)
Computer	15, 18 lb (17 x 22 in., 500 sheets)

1. Typical weights offered by producers. Other weights may be available
2. Catalog grades

GPO MINIMUM ACCEPTABLE PROPERTIES FOR GROUNDWOOD PAPER FORMS

Basis weight				
lb*	12	15	18	20
g/m^2	45	56	68	75
Burst	7	8	11	14
Opacity, %	80	80	80	80
Caliper				
0.001 in.	2.8	3.5	4.2	4.6
mm	0.071	0.089	0.109	0.117

* Ream size: 17 x 22 in., 500 sheets

variety of market and production strengths of these mills has dictated an increasing range of marketing approaches on the part of producers.

One of the newer markets for uncoated groundwood paper is groundwood forms, a market that has been growing by 15% to 35%/year in recent years. Used for computer printouts, generally for companies' internal sales documentation and reports, groundwood forms represent a low-cost alternative to free-sheet forms bond. List price differential between groundwood and free-sheet forms paper recently has been close to $250/ton, with a new free-sheet/groundwood blend priced more or less in between. In weak markets, however, such as the situation in 1981 and 1982, discounts can erode the price advantage of blends and even of groundwood forms, and thus slow the growth of the groundwood product. Also there is some question of whether groundwood forms demand growth will slow in coming years as customer resistance to its inferior appearance compared to free-sheet begins to close off further avenues for penetration into the office.

PRODUCTION/CAPACITY

U.S. production of uncoated groundwood papers grew at a rapid rate during the 1970s but then turned downward during the prolonged economic stagnation that began in 1979 and continued into the early 1980s. American Paper Institute figures indicate shipments in 1981 fell 3.8% to 1.441 million short tons, while 1980's shipment level was another 0.7% below 1979. Shipment figures for early 1982 showed a continuation of the downward trend, which appears to arise from the position of uncoated groundwood papers as an intermediate product between newsprint and lightweight coated paper.

A note of caution should be sounded in assessing shipment numbers, however, since Canadian Pulp & Paper Assn. figures include some upgraded newsprint within newsprint production and capacity estimates, even though it is sold at a higher price than standard newsprint and might more legitimately be included within the groundwood specialties. Because the line between groundwood and newsprint is such a fine one, upgraded newsprint papers can also be used for purposes other than traditional newsprint end-uses without the mill necessarily knowing about it, further skewing both CPPA and API figures.

API estimates U.S. uncoated groundwood capacity in 1982 reached 1.774 million short tons, while CPPA figures show 865,000 short tpy of Canadian capacity in that year. But Pulp & Paper estimates show as much as 1.6 million tpy of Canadian capacity, and one executive cites an estimate by Strategic Futures Inc. that up to 1.1 million short tpy of "newsprint" coming into the U.S. from Canada would actually fit into the category of uncoated groundwood, according to price or specification criteria, indicating a Canadian uncoated groundwood capacity of roughly 2.0 million tpy.

ESTIMATED CAPACITIES FOR UNCOATED GROUNDWOOD PAPER OF MAJOR COMPANIES

	Estimated capacity (000 tons)		Capacity N. American market	
	U.S.	Canada	Total	%
1. Abitibi-Price Inc.	—	425	425	11.4
2. Great Northern Nekoosa	402	—	402	10.8
3. CIP Inc.	—	380	380	10.2
4. Consolidated-Bathurst Ltd.	—	352	352	9.4
5. MacMillan Bloedel	—	347	347	9.3
6. Boise Cascade Corp.	40	260	300	8.0
7. St. Regis Paper Co.	225	—	225	6.0
8. Domtar Inc.	—	163	163	4.4
9. Fraser Inc.	135	—	135	3.6
10. Madison Paper	130	—	130	3.5
11. Crown Zellerbach	130	—	130	3.5
12. Kimberly-Clark Corp.	93	28	121	3.2
13. Bowater Inc.	70	—	70	1.9
14. Pejepscot Paper[1]	57	—	57	1.5
15. Wausau Paper Mills[2]	30	—	30	0.8

North American capacity (1982): 3.729 million tons
U.S.: 1,774; Canada, 1.955
Capacity share of top five companies: 51.1%
Capacity share of top ten companies: 76.7%

[1] Subsidiary of Hearst Corp.
[2] Hennepin Paper Co.

Tariff considerations are behind the unreasonably low level of CPPA figures. API figures are believed to be considerably more reflective of the real market situation. Assuming they are not far off from the truth, total North American capacity approaches 3.4 million tpy. Official CPPA figures show a 10.2% increase in capacity between 1982 and 1983, while API shows U.S. capacity remaining flat in that period. The only significant change in U.S. capacity recently was the late-1981 startup of Madison's 165,000-tpy sc machine in Madison, Maine, along with an incremental expansion of 6,500 tpy at Crown Zellerbach's Port Angeles, Wash., mill that same year, while an estimated 58,000 tpy had been shut down or switched to other grades in 1980, with no significant expansions.

A variety of Canadian mills are either converting capacity to produce uncoated groundwood or are installing new machines, including a planned 77,000 short tpy machine at Consolidated-Bathurst's Trois Rivières, Que., mill, with startup scheduled in 1982. Indeed, one executive estimates there may be as much as 1 million tpy of capacity converted from newsprint to uncoated groundwood in the next five years, a prospect with profound implications for market conditions in the remainder of the decade.

OUTLOOK

Uncoated groundwood mills should be optimistic about their future in the 1980s, with a variety of end-use markets that should consume significantly more paper as the period progresses. But because of the intermediate status of these papers between newsprint and LWC, the actual prospects depend as much on what other paper is available to the same end-use markets as on how much total paper will be consumed by those markets. And the capacity of competing sheets appears to be adequate and growing rapidly.

U.S. capacity of coated groundwood was expected by API to jump by 571,000 tpy from 1981 to 1983, and industry observers believe as much as 400,000 tpy of that may be excess in 1983. Coated groundwood and uncoated groundwood compete in several of the major paper markets, especially magazines and catalogs, and with demand growth basically flat in 1982, the 1981-83 demand trend for all papers going into those markets was expected to show an increase of only 100,000 tons of all papers in the magazine market and 100,000 tons of all papers going into catalogs—leaving a lot of uncoated and coated groundwood looking for a home. The end-result of that will be fierce competition between the two grades.

Some magazines are expected to increase their use of uncoated groundwood as cost pressures mount on small, specialized publications. Directories will continue to consume almost nothing but uncoated groundwood paper, and most observers expect double-digit demand growth to continue in groundwood forms. But use of all kinds of paper in newspaper inserts and advertising circulars is not expected to grow by more than 5%/year. And magazines and catalogs that have in recent years used uncoated groundwood because of a shortage of LWC will return to coated paper once coated capacity greatly exceeds supply, observers say—a situation that was already in place in the second half of 1982.

Indeed, one executive cites a Merrill Lynch Economics forecast that uncoated groundwood shipments in 1983 will be virtually the same as 1980 shipments, and slightly below the 1.509 million-ton level of 1979. This indicates an overall loss of market share on the part of uncoated groundwood in several of its major end-use markets.

Once new LWC capacity is absorbed, however,

U.S. PRODUCTION AND CAPACITY FOR UNCOATED GROUNDWOOD PAPER

(000 short tons)

	Production		
	Census	API[1]	Capacity[2]
1983	—	—	1799
1982	—	1412[3]	1774
1981	1451	1447	1658
1980	1538	1498	1624
1979	1674	1474	1537
1978	1569	1309	1453
1977	1578	1330	1367
1976	1550	1294	1309
1975	1293	1113	1329
1974	1411	1173	1280
1973	1416	1156	1403
1972	1308	1106	1442
1971	1186	1074	1363
1970	1214	1075	1230
1969	1208	1089	1296

1. Shipments
2. Source: American Paper Institute, 1982
3. P&P estimate

UNCOATED GROUNDWOOD PAPER: U.S. EXPORTS AND IMPORTS

(000 short tons)

	Exports[1]	Imports[2]
1981	120	459
1980	101	488
1979	80	798
1978	58[1]	515[2]
1977	54	172
1976	71	137
1975	74	84
1974	53	110
1973	29	120
1972	18	142
1971	10	156
1970	7	218

1. Prior to 1978, Census classification was groundwood paper, printing, writing and converting, uncoated. From 1978, classification was printing and writing papers, over 10% mechanical pulp, uncoated.
2. Prior to 1978, Census classification was uncoated book and printing paper with over 25% mechanical pulp. From 1978, classification was the same except for mechanical pulp content, which was reclassified as over 10% mechanical pulp.

Source: Bureau of the Census

UNCOATED GROUNDWOOD PAPERS: CANADIAN PRODUCTION, EXPORTS, AND CAPACITY

(000 short tons)

	Production[1]	Exports[2]	Capacity[3]
1983	—	—	953
1982	—	—	865
1981	711	320	800
1980	677	305	728
1979	625	321	702
1978	580	266	675
1977	463	193	560
1976	363	133	480
1975	315	140	402
1974	401	183	440
1973	319[3]	184	412

1. CPPA
2. Statistics Canada
3. P&P estimate

UNCOATED GROUNDWOOD PAPERS: U.S. PRICE HISTORY

($/ton, year-end)

	Catalog (25-lb roto)[1]	Premium rotonews (30-lb)
1982*	$551	$515/520
1981	551	500/515
1980	515	475
1979	468	404
1978	425	375
1977	405	330
1976	345	n.a.
1975	320	n.a.
1974	320	n.a.
1973	200	n.a.
1972	175	n.a.

1. Prices for other grades vary but the following approximate prices existed in second quarter, 1980: (1) Directory, 22.5-lb yellow, $680/ton; (2) Directory, 22.5-lb white, $650/ton; (3) Supercalendered uncoated groundwood magazine paper, 34-lb, $635/ton.

* 2nd-quarter announced price

Source: P&P WEEK, P&P WEEK DATABOOK 1980

uncoated groundwood mills could enjoy fairly healthy market conditions for several years. And once coated groundwood operating rates, in the mid-1980s, climb back to the 92% to 94% range that has traditionally been required to support price hikes—from the 84.6% forecast for 1982—the 15% to 35% price advantage traditionally held by uncoated groundwood should reassert itself. This will strengthen the position of uncoated groundwood as the low-cost alternative for catalog and magazine publishers priced out of the coated paper markets.

A strong competitor for magazine orders should be sc papers such as that produced by Madison Paper Industries, although a Madison marketing official told *Folio* magazine in April 1982 that few magazines had made the switch to sc so far. Those that had changed that he listed—*VFW Magazine*, *Elks Magazine* and *Guideposts*—were concentrated in the "fraternal publication" area, where advertising revenues are low or nonexistent and costs are a constant problem. The official also indicated that *TV Guide* and *Better Homes and Gardens* were testing the paper, while a Dallas *Morning News* Sunday supplement had made the switch and the *Atlanta Constitution*'s Sunday magazine was considering a similar move. Market observers also said in 1982 that *Consumers Reports* was considering printing on sc paper.

Major end-use markets for uncoated groundwood are expected to show fairly stable growth rates of around 5%/year for several years, and if uncoated groundwood capacity does not suffer from the kind of explosion that is now plaguing coated paper, operating rates should be respectable during the middle years of the decade.

Indeed, consumption of directory paper by some telephone companies was growing at double-digit rates during the late 1970s: General Telephone Directory Co. said its paper use rose at 15%/year for several years. But most telephone directory publishers have recently enacted paper-saving mechanisms, including less-frequent publication of directories and printing of a smaller number of books. This may lead to slower growth in directory paper consumption in coming years.

The long-term outlook for demand for both directory and catalog papers is clouded by the possibility of competing services being offered by electronic mechanisms. American Telephone & Telegraph is believed to be actively considering ways of introducing "electronic Yellow Pages" service, and the French national telephone company may be pioneering the way towards inexpensive electronic directory systems through its plan to replace all phone books with electronic terminals by 1995.

Catalog papers, too, could be affected by the advent of electronic terminals, if they ever reach the home in large numbers. Recent polls of catalog publishers and other merchandisers indicate they expect to see a significant switch to electronic means eventually, although probably not before the 1990s, or the late 1980s at the earliest. Sears, Roebuck conducted a highly-publicized experiment in 1981 in the potential customer acceptance of a videodisc catalog, in which Washington, D.C.-area stores and 1000 homes equipped with videodiscs received disc catalogs in addition to paper catalogs. A Sears official told an API meeting in late 1981 that "in our judgment, the Sears catalogs will never be completely supplanted by electronics," adding that it should be six or seven years before "the electronic revolution makes its first modest inroads into the use of paper in the catalog business."

Sears did not find its customers quick to accept the new system. But the economics of the idea seemed attractive to the company: the Sears executive estimated that 90% of the $250 million/year his company spends producing catalogs goes into printing and distribution, with the remaining 10% apparently consisting of such costs as photography and text-writing. Thus an electronic system that could cut that 90% portion substantially—if there ever is one—would attract a lot of attention among catalog publishers.

Another effect of the "electronic revolution" could actually help demand for uncoated groundwood paper—the explosion of office computer printers and intelligent copiers. One executive says an API study cites a projection that the number of high-speed electronic printers installed in the U.S. will jump by 266% between 1980 and 1985, and the number of small, inexpensive and less sophisticated computer printers is also expected to grow rapidly. Businesses are increasingly using intelligent copiers to generate forms on plain paper, instead of using pre-printed forms, and Abitibi-Price Inc. and others are known to be working to produce a groundwood forms paper that will run efficiently through high-speed office printers. Manufacturers producing free-sheet forms bond say such a product would be a serious competitor in the fast-growing forms market, and most observers expect groundwood forms to continue roughly the 16%/year growth rate attained in 1981.

So far uncoated groundwood's contribution to the forms industry has been small, with only 11% of the 2.2 million tons of paper shipped to business forms converters in 1981 being uncoated groundwood. And although this is the fastest-growing segment of the forms industry—by a factor of about three to one—there is serious resistance to incorporating groundwood paper in forms circulated outside the customer's office. The estimated 36% of all business forms represented by transaction documents would appear to be impervious to penetration by groundwood forms. That still leaves a large portion for groundwood mills to compete for in entering the forms market, however.

UNCOATED GROUNDWOOD EXPANSIONS

Company	Location	Annual short tons	Startup
Madison Paper	Madison, Maine	165,000	1981
Consolidated-Bathurst	Trois Rivieres, Que.	76,000	1982
Ontario Paper Co.	Thorold, Ont.	74,000	1982
Abitibi-Price	Beaupre, Que.	160,000	1983

*Two new newsprint machines starting up, one of which also has rated capacity to produce uncoated groundwood in this amount, and will be dedicated to producing this amount of this grade.

Source: P&P WEEK, P&P PROJECT REPORT

COATED PAPERS

GRADE STRUCTURE

Coated paper generally falls within two groups, depending on whether the paper is coated on one side (C1S) or on two sides (C2S). C1S paper, representing just over 8% of all coated paper production in 1981, is generally used for labels, while major C2S end-uses include publications and commercial printing.

C2S papers range in quality downward from the No. 1 grade, representing the most expensive and high-quality sheet, to No. 5, at the other end of the scale in quality and price. Nos. 1 through 3 are made essentially from chemical pulps while No. 4 can contain a large amount of mechanical pulp and No. 5 always contains a high percentage of mechanical pulp. No. 5 is the most important in terms of tonnage, and each successively higher-quality grade is smaller in terms of tonnage than the one below it. According to one estimate, No. 1 represented only 3.5% of C2S production in 1981 while No. 2 was 7.5%, No. 3 was 15.5%, No. 4 was 18% and No. 5 was 55.5%.

Some shift in market share has been seen among the C2S grades in the last 20 years, with coated No. 5 losing share over the years to Nos. 3 and 4. No. 5's share in 1981, at 55.5%, was well above the combined 33.5% share of Nos. 3 and 4. But in 1971 the split was 27% for Nos. 3 and 4, against 67% for No. 5. A decade earlier than that the market-share split was even more dramatic.

Within these major categories, different grades are produced to fit the requirements of various printing methods, including letterpress, offset and rotogravure. Offset represents the largest portion of C2S publication papers and has been growing in importance at a fairly rapid rate. According to one estimate, offset represented only 19% of all C2S paper in 1964, but rose to 55% by 1971. The percentage jumped to 73% by 1980, a year when letterpress represented 14%—down from 35% in 1971—and gravure was 13%—up from 9.5% in 1971.

Offset printing demands paper with smooth surface and good pick resistance due to the tacky inks used. Letterpress printing is relatively less demanding as far as surface properties are concerned, but is governed by a basis-weight minimum because of a problem with strikethrough in low-basis-weight papers. Gravure printing, preferred for long press runs, requires a smooth surface, along with controlled ink receptivity.

Paper coating methods also vary according to quality desired along with speed of operation. The trend in recent years has been toward on-machine coating, although off-machine coating is still common among many older commodity-grade coated paper mills and specialty grade mills. Most frequent arrangement is for one coating station to apply coating to a side, although the same station can be used to apply coating simultan-

U.S. STATISTICS FOR COATED GROUNDWOOD PUBLICATION PAPERS

	1980	1981	1982e
Production*, 000 tons[1]	2555	2804	2845
Capacity[2], 000 tons	2762	3081	3364
Utilization rates, %	92.5	91.1	84.6
Imports, 000 tons	110	35	20
Export, 000 tons	45	46	45
Apparent U.S. consumption			
000 tons	2620	2793	2820
lb/capita	23.54	24.85	24.83
000 tons/$ billions real GNP (1972)	1.769	1.852	1.868

* PULP & PAPER estimate

[1] All tons are short tons

[2] API capacity data, includes coated grade No. 5 and some coated No. 4

eously to both sides. Paper can also receive two coats on the same side, or a precoat may be applied to smooth out surface roughness.

Coating formulations may vary but a typical coating solution consists of pigments (kaolin clay, titanium dioxide or calcium carbonate), binders, and additives to control viscosity and other rheological properties. Excess water must be dried from the coating in a fast and efficient manner, since water makes up as much as 50% of a coating formulation, and common methods are through-air drying, drum drying or infrared drying.

After excess water is removed, the coated sheet is next supercalendered if a glossy finish is desired, and it may be supercalendered through the nip of many rolls to develop the gloss further. If a high-gloss finish is required, as with an enameled sheet, a gloss calender is used. Dull finish and matte finish are distinguished by the supercalendering process—or lack of it, in the case of some dull finish paper. Dull finish paper gets light pressure from the supercalender, or none at all, while matte finish paper goes through a supercalender with one stack that has been sandblasted or engraved to imprint the matte appearance. Paper is considered to be matte finished if it gives a gloss test reading of 20 or less, while dull finish could reach 45 or 55 on the gloss scale and glossy finish would be higher.

The bulk of C2S paper is given a glossy finish, although matte finish has made some gains in market share in recent years. One estimate claims that glossy coated represented 89% of all C2S paper in 1970 but slipped marginally to 86.5% in 1976, while matte finished paper rose from 6% to 10% in that period. Dull finish remained basically unchanged at about 3% of all C2S shipments. During that time coated No. 5 remained over 90% glossy, although the percentage of No. 5 made with a glossy finish fell from 95% to 93%, with matte rising to 6.5% of all No. 5 from 3.5% in 1970.

INDUSTRY STRUCTURE

Coated paper production is concentrated in a small number of hands, with 16 companies claiming virtually all of industry capacity, and about half of the capacity controlled by five top companies. Within specific areas of the industry the concentration is even greater.

In No. 5, the top five companies are estimated to represent 62% of total capacity for that grade. St. Regis Paper, the second-largest manufacturer of that grade, was proceeding with installation of a 168,000-tpy No. 5 coated paper machine in Sartell, Minn., with startup scheduled for mid-1982. Weyerhaeuser Co. and Mead Corp. were moving ahead with plans for startup at the same time of light-to-medium-weight coated groundwood paper machines to make coated No. 4 or 5, at Columbus, Miss., in the case of Weyerhaeuser (new 175,000-tpy machine) and at Escanaba, Mich., in the case of Mead (new 200,000-tpy machine).

In Nos. 1 to 3, four companies dominate: Champion International, Consolidated Papers, Scott Paper and Westvaco. All four have either planned or contemplated further capacity expansion in the next few years, although only Scott (200,000 tpy at Skowhegan, Maine; startup first-half 1983) has actually begun installation of a new machine.

Coated paper shipments in Canada were about 185,000 metric tons in 1981, down from about 237,000 tons the year before, with coated groundwood ranging

U.S. COATED PAPER PRODUCTION

(000 short tons)

	API	P&P estimates[2]			
	(total coated)[1]	(total coated one-side)	(total coated two-sides)	(total C2S Nos. 1-4)	(total C2S No. 5)
1981	4951	395	4485	2035	2450
1980	4673	375	4240	1840	2400
1979	4642	410	4230	2080	2150
1978	4593	440	4155	2000	2155
1977	4274	415	3860	1640	2220
1976	3890	410	3480	1490	1990
1975	3076	330	2740	1120	1620
1974	3739	410	3330	1650	1680
1973	3757	435	3320	1430	1890
1972	3455	400	3055	1040	2015
1971	3165	360	2805	905	1900

1. Shipments for both one- and two-side coated papers
2. May not add up due to rounding

U.S. COATED PAPER CAPACITY

(000 short tons)

	Coated free sheet	% change	Coated ground-wood*	% change
1984	2492	5.6	3750	2.7
1983	2359	4.7	3652	8.6
1982	2254	1.3	3364	9.2
1981	2226	0.2	3081	11.5
1980	2222	0.4	2762	10.1
1979	2214	5.6	2511	2.5
1978	2096	5.4	2450	1.7
1977	1989	4.5	2408	12.2
1976	1903	−1.5	2299	8.1
1975	1938	—	2127	−4.8
1974		total coated grades	4075	0.7
1973			4045	4.6
1972			3866	0.2
1971			3778	0.2
1970			3700	−0.1
1969			3732	—

* Includes all coated paper capacity until 1975

Source: American Paper Institute

U.S. PRICES FOR COATED PUBLICATION PAPER

($ per short ton)

	No. 1 70-lb sheets	No.3 60-lb rolls	No. 5 32-36-lb rolls
1982			
2nd quarter	1130	920	760
1st quarter	1130	920	760
Year-end			
1981	1130	920	760
1980	1038	858	735
1979	970	786	671
1978	893	712	573/590
1977	*	702	520/545
1976		643	460
1975		584	399
1974		574	378
1973		*	*

* Earlier data not available

Source: P&P WEEK, P&P WEEK DATABOOK 1980

from 76% of that total in 1980 down to 71% the following year. Coated groundwood represented the large majority of the coated paper production drop, with exports of coated groundwood falling more than 50,000 metric tons in 1981 from 1980 levels. Kruger (which completed a 72,000 metric tpy expansion at Three Rivers, Que., in 1979) is the most important factor in the Canadian coated paper industry. Much of its capacity is believed to be intended for export to the U.S., with the rest, along with capacity of other producers, serving Canada's domestic needs. Canadian mills have never made a permanently safe niche for themselves in the U.S., and tend to be the first to suffer when capacity greatly exceeds supply, as in 1982.

TRENDS IN LWC PUBLICATION GRADES

Most important market for lightweight coated paper (under 40-lb basis weight) is magazines, and magazine demand trends dictate LWC supply trends. Mailing cost of the average U.S. magazine rose from about 1.8¢ in 1970 to 8¢ or more in 1980 and 1981, and the crunch on delivery costs forced publishers to begin seeking ways to cut expenses. Paper basis weight became a prime candidate.

In the early 1970s, LWC for high-volume magazines such as *Time* and *Business Week* was considered to be 40-lb paper. One estimate places paper below 36-lb at about 10% of all coated No. 5 shipments in 1970, rising to 20% in 1976. Paper between 36-lb and 40-lb grew from 32% in 1970 to 13% six years later. Those trends have continued since then, with 34-lb paper now the major lightweight grade and papers as light as 32-lb and 30-lb appearing in the market as well.

While publishers that formerly printed on 40-lb paper have moved toward 34-lb stock, publishers that previously opted for 50-lb paper have shifted down toward 45-lb or 40-lb. On the other hand, early figures during the economic slowdown that began in 1979 and went into the early 1980s indicate specialty magazines that could be targeted toward particular audiences—thus increasing the cost-effectiveness of advertising while appealing, often, to wealthier audiences—were increasing their share of the magazine market.

During much of 1981, the number of second-class pieces handled by U.S. Postal Service went down while the total weight rose. In the fourth quarter, according to one estimate, the number of pieces mailed dropped by nearly 5.5% from the same period of 1980, while the weight in pounds climbed by just over 5%. If that trend continues, it would give some modest renewed strength to the 40- to 50-lb segment of the coated groundwood market.

Not all the arguments are in favor of reducing basis weight. Since publishers print paper on an area basis but buy it on a weight basis, they pay a premium for lightweight paper. Also, press runability falls as basis weight declines, resulting in greater paper losses.

The magazines that have gone farthest in reducing basis weights have been those with mass circulations where postage savings are greatest. Such magazines are often intended for a market that will pay less per copy, and absorb newsstand or subscription price increases less readily than specialty magazines. Popularity of LWC, thus, will at least partly depend on ability of the mass-market magazines to compete with television and newspapers for advertising. Another recent trend whose impact on paper use could not yet be quantified was the increased experimentation on the part of some mass-market magazines with private distribution systems in urban areas.

Technological efforts in LWC mills have centered around maintaining surface properties and runability while cutting weight. Publishers place greater value on runability and printing characteristics (such as ink holdout and ink gloss) than on opacity, and the mechanical integrity of the sheet—i.e., no flaws—becomes more important.

Once basis weights fall below about 36 lb, it becomes important to reduce weight of both the basestock and the coating. Some mills make the reductions primarily in coat weight—going to a 6-lb coating, for example, from a 10-lb or more—while others reduce the weight of the basestock by a greater percentage. Some mills can use a lighter-weight basesheet than others. Surface smoothness is the deciding factor.

Mills add kraft fiber to lend tearing strength, as well as to avoid breaks, carry flaws and maintain paper machine and press runability. But a large proportion of the sheet comes from groundwood fiber, which offers reduced cost, while maintaining opacity and surface smoothness.

Stone groundwood has higher opacity than thermomechanical pulp, but mills such as Weyerhaeuser Co.'s new Columbus, Miss., coated groundwood mill have chosen to use TMP pulp because of its greater strength, which allows for reduced chemical pulp content and may help out with the shorter-fiber Southern pulp in the case of southern mills. Because of its ability to cut chemical pulp usage, TMP should find its way into more coated groundwood sheets in the future as capacity is added.

Titanium dioxide is favored in LWC coating, with specialized clay such as delaminated grades providing the balance of the coating's content. Below 32-lb, synthetic organic pigments are used. With densities about half that of clay—allowing for a 3-lb coat weight,

TYPICAL PROPERTIES OF COATED PUBLICATION GRADES

General characteristics	Typical use	Basestock	Coating	Brightness
No. 1 Enameled, double-coated, hand-sorted expensive base and coating; high gloss; basis weight above 70 lb	Annual reports heavily filled synthetics	High-brightness chemical pulp enameled;	High in TiO_2; high gloss	82-88
No. 2 Double-coated, expensive base and coating	Expensive advertising filled (clay)	High-brightness chemical pulp; synthetics	High in TiO_2 some clay;	78-82
No. 3 Single- or double-coated, lower-quality basesheet	Advertising minor amounts of groundwood	Chemical pulp; some TiO_2 less expensive	Mostly clay,	76-82
No. 4 Lower cost, lower brightness pulp, some clay filler	Magazine and chemical coating—clay and TiO_2	Groundwood expensive;	Less	72-78
No. 5 Lower basis weight, high groundwood content	Directories, catalogs, magazines for runability	Mostly groundwood or TMP, chemical pulp	Variable, some contain synthetics	68-72

Source: PULP & PAPER, May 1980

for example, instead of a 6-lb coating—these pigments allow for retention of much of the basis weight of the basesheet. Most mills making LWC have at least run successful trials using synthetics, but sheets below 32-lb are still rare and thus synthetics have not yet gained the prominence of clay.

MARKETS FOR COATED PAPERS

Magazines represent the largest market for coated paper, using 43% of all coated-two-sides (C2S) paper production in 1981. At various times in the past decade that percentage has ranged as high as 52%—in terms of 1981 C2S output levels, a swing of more than 400,000 tpy. According to one estimate, of the 2.1 million tons of paper used by magazines in 1981, 1.98 million tons were coated, with 3.5% of paper shipments to magazines coming from Nos. 1 to 3, 16% coming from No. 4 and 75% from No. 5.

There has also been a trend toward lighter basis weights in publication-grade paper. Total shipments of No. 5 in recent years have risen at close to 9%/year, but the under-36-lb class has grown at 13%/year and better.

Another major market, where coated paper demand has been rising strongly, is catalogs, taking more than 375,000 tons of coated paper in 1981—17% more than the previous year. Nos. 3 and 4 are the fastest growing segments of the coated catalog paper market, but No. 5, with about 325,000 tons in 1981, was still the biggest segment—with a healthy 14% growth rate to its credit.

COATED PAPER SHIPMENTS TO MAGAZINE PUBLISHERS (1978-81)

(000 short tons)

Grade	**1978**	**1979**	**1980**	**1981**
Coated two-sides	1902	1838	1969	2009
Nos. 1-4	365	400	405	408
No. 5	1537	1438	1564	1601
All grades	2054	2017	2125	2185
Coated paper imports	214	189	115	36

Source: American Paper Institute and Champion International Corp.

Only about 250,000 tpy of coated paper was going into the book market in the early 1980s, but in 1981 that grew at 7.5% while shipments of all papers to book publishers were flat, indicating an increased publisher preference for the better graphic qualities of coated paper.

The other major market was commercial printing, with nearly 1.8 million tons of coated paper going into

NEW U.S. COATED PAPER CAPACITY THROUGH 1984

Announced projects	**Location**	**Annual short tons**	**Startup**
Coated groundwood (Nos. 4 and 5)			
Mead[1]	Escanaba, Mich	200,000	1982
Midtec[2]	Kimberly, Wis.	n.a.	1982
St. Regis[1]	Sartell, Minn.	170,000	1982
Weyerhaeuser[1]	Columbus, Miss.	175,000	1982
Pentair/Niagara*	Niagara, Wis.	n.a.	1984
Blandin Paper*	Grand Rapids, Mich.	n.a.	n.a.
Weyerhaeuser[3]	Columbus, Miss.	n.a.	n.a.
Coated free-sheet (Nos. 1 to 3)			
Scott[1]	Skowhegan, Me.	200,000	1983
Consolidated[2]	Stevens Pt., Wis.	11,000	1984
Champion[1]*	Quinnesec, Mich.	n.a.	n.a.
Westvaco[1]*	Luke, Md. or Wycliffe, Ky.	150,000	n.a.

* Under study—not formally approved

1. New machine
2. Speedup or modernization
3. Postponed indefinitely but not cancelled

Source: Pulp & Paper Week, Pulp & Paper Project Report that market in 1981. Of the coated paper segment of commercial printing, the market share split by grade was as follows: No. 1, 8%; No. 2, 17%; No. 3, 30%; No. 4, 20%; No. 5, 24%. Commercial printing takes up about 36% of all coated paper production.

Some efforts have been made in recent years to increase the coated groundwood market share of the commercial printing market through coating variations to improve the brightness from a typical coated groundwood range, say, of 70 to 72 (GE) to a range more conducive to sales in the commercial printing segment—somewhere between the 74 (GE) of St. Regis' new high-brightness brand and the 78 of International Paper's new Web high-brightness sheet. Some companies that have marketed high-brightness coated groundwoods on a regular or experimental basis include IP, Crown Zellerbach, St. Regis, Fraser and Nitec/Midtec.

With the exception of a 40- to 45-lb Fraser Paper product which appears at this writing to be still in its experimental stages, most of the small number of high-brightness groundwoods are in the 45- to 70-lb range. They may have as much as 35% to 50% groundwood content in their furnish, but with brightness ratings in the mid-to-high 70s they can approach the 79 or 80 of a typical free-sheet No. 3 or 4 aimed at commercial printers.

Price is the most notable difference, with one 50-lb high-brightness groundwood priced at $780/ton and competing head-to-head with coated free-sheet papers priced at $860. The product can have a smoothness comparable to free-sheet and less ink puff than the typical LWCs. Being groundwood, they have more opacity and strength than free-sheets, but observers say the market has yet to determine whether they can produce the printing qualities needed to enable them to replace free-sheet in large quantities.

CANADIAN FINE PAPER PRODUCERS[1] ESTIMATED ANNUAL CAPACITY

(000 short tons)

	Coated & uncoated	Coated
Domtar	400	70
Eddy	172	—
Rolland	162	24
Kruger	140	140
Abitibi	125	125
Fraser	90	14
Great Lakes Forest Products	69	—
MacMillan Bloedel Ltd.	42	—

[1] Does not include uncoated groundwood printing grades

PAPER SHIPMENTS TO COMMERCIAL PRINTERS

(000 short tons)

Grade	1980	1981
Coated two sides paper	1650	1750
C2S Nos. 1-4	1200	1300
C2S No. 5	405	420
Uncoated free-sheet	2000	1950
Uncoated groundwood	220	175
Total	3800	3900

Source: PULP & PAPER estimates

Coated-one-side paper totals around 400,000 tpy, of which about 83% goes into labels, representing 94% of all label paper.

OUTLOOK FOR COATED PAPERS

Coated paper demand is expected to continue at recent growth rates, which have averaged several points over Gross National Product growth rates. Publishers and printers alike have shown a preference for the superior printing qualities of coated paper as opposed to either uncoated free-sheet or uncoated groundwood in an increasing number of instances.

Coated paper shipment levels to magazine publishers between 1978 and 1981 remained almost flat, however, rising by only 6.4% in that time as domestic production replaced imports. By 1982 imports had been whittled down to near an irreducible minimum, projected to total only 45,000 tons in that year, creating the potential for a rise in domestic shipments to magazines over the next few years.

One question mark for coated paper has been the degree to which uncoated groundwood would poach on traditional coated paper markets such as magazines. The startup of Madison Paper Industries' new 165,000-tpy supercalendered uncoated groundwood paper machine in Madison, Maine, in late 1981 introduced a new competitive element into the publication papers market in North America, roughly doubling U.S. SC paper capacity almost overnight. Madison, St. Regis and CIP Inc., the three major North American producers of top-quality SC paper, may have the opportunity to capture a number of small magazines from LWC with their $100/ton price advantage over LWC, especially if predictions of rising cost pressures on small magazines are borne out.

On the other hand, excessive coated No. 5 capacity will prevent SC mills from gaining any business because of a shortage of available LWC. At the same time, coated paper mills looking for new business will, in many cases, have little trouble in taking catalog and

RISE OF ROLLSTOCK VS SHEET-FED PAPER IN U.S. COATED PAPER INDUSTRY

(% of total coated paper shipments)

	Rolls	Sheets
1980	85%	15%
1975	80	20
1970	80	20
1965	77	23

Source: PULP & PAPER estimates

U.S. COATED PAPER EXPORT/IMPORT BALANCE

(000 short tons)

	Exports[1]	Imports[2]
1982e	90	30
1981	89	39
1980	92	115
1979	74	189
1978	74	214
1977	99	113[3]
1976	107	—
1975	123	—
1974	99	—
1973	80	—
1972	76	—
1971	76	—
1970	75	—
1969	70	—

e = PULP & PAPER estimate

1. Clay-coated printing and writing paper
2. Coated and impregnated printing papers
3. In previous years, coated paper imports were reported under another category.

Source: Bureau of the Census

commercial printing orders away from uncoated groundwood, and coated paper's market share of all its major markets is expected to remain even or increase in the next five years.

But that doesn't mean all segments of the coated paper industry will necessarily enjoy high operating rates and a corresponding success in raising prices. If demand for coated paper continues to exceed GNP by two or three points, that should mean the industry ought to be building as much as 250,000 tpy of new capacity over the next few years. Unfortunately, capacity additions in the years 1981-84 are currently expected to average 314,000 tpy. Furthermore, the large majority of that is in coated groundwood, indicating a continued high operating rate for coated free-sheet—in the mid-to-high 90s for most of that period—but a poor rate for coated groundwood, averaging in the mid-to-high 80s.

The likelihood is also not great for wholesale capacity shutdowns during that period that would pare down the sector's capacity. In American Paper Institute's 1980-83 capacity survey, API listed only 6,000 tpy of printing/writing paper capacity as candidates for permanent shutdown in the next year, out of 609,000 tpy for the whole paper/paperboard industry, and the same survey showed 49.6% of all coated paper machines have capacity for 76,000 tpy or greater—a higher proportion than for uncoated groundwood or uncoated free-sheet. Recent modernizations in the coated paper segment have greatly improved the efficiency of this sector, leaving less inefficient capacity to remove than in many other sectors of the industry.

Despite the continued capacity problems of the coated groundwood sector, coated paper as a whole is likely to see its major end-uses clamoring for more paper each year. Magazines continued largely to hold their own in their market-share battle with television, claiming 5.9% of all advertising dollars in 1980 compared with 5.2% in 1975—while TV remained close to 20% in the same period. Television has largely flattened out and recent trends have shown TV ad rates rising much faster per 1000 persons reached than print-media ad rates. Network television costs were expected to go up by 64% between 1979 and 1984, compared with only 32% for magazines.

Specialty magazines strengthened the total print market, relying on relatively targeted approaches that reach sectors of the population with often greater per capita consumption patterns than either televison or the mass-market magazines. There is some question of whether costs will begin to catch up with smaller magazines toward the middle of the decade, however, while some industry observers believe many specialty magazine markets may begin to be saturated in the next two or three years.

A further potential cloud on the horizon could be the threat of competition from videodiscs, offering superior graphic capabilities and a novelty factor that magazines can't compete with. This development is not likely to affect magazines seriously before the 1990s, however.

Commercial printing demand for coated paper remained surprisingly strong through the recession of the early 1980s, but predictions that web offset printing would continue to grow at the expense of sheet-fed offset printers and letterpress printing were not entirely borne out. Although about 85% of C2S paper goes into rolls, and only 15% into sheets, the high interest rates of the period seemed to be giving smaller sheet-fed printers a new—even if only temporary—lease on life as customers turn to short but frequent runs, as opposed to longer but less frequent runs, in order to minimize inventories.

UNCOATED FREE-SHEET

GRADE STRUCTURE

Uncoated printing and writing papers find their way into a variety of end-uses ranging from personal stationery to carbonless basestock for business forms, and the one uniting characteristic is that they are all uncoated papers made largely from chemical pulps (sulfate, sulfite, soda, cotton linter or vegetable fiber). Most contain no mechanical pulp at all, although paper with up to 10% mechanical pulp can still be classified as uncoated free-sheet and therefore be included within this category.

Four major subgroupings can be discerned within the uncoated printing/writing paper family, based on end-use: publishing, commercial printing, office and writing paper. A fifth and smaller subgrouping includes minor products such as cigaret papers and carbonizing tissue (discussed under the heading Thin Papers).

U.S. STATISTICS FOR UNCOATED PRINTING/WRITING PAPERS

	1980	1981	1982e
Production*, 000 tons[1]	7983	7861	7850
Capacity, 000 tons	8645	8791	9017
Utilization rate, %	92.3	89.4	87.1
Imports, 000 tons	116	112	100
Apparent U.S. consumption			
000 tons	8011	7853	7830
lb/capita	72.0	69.0	70.0
000 tons/$ billion real GNP (1972)	5.41	5.21	5.17

e = estimated
* API data for shipments
1. All tons are short tons

Source: PULP & PAPER

Most important end-uses in terms of tonnage are offset printing paper, representing about 24% of all shipments in 1981; bond/mimeo/duplicating/-xerographic, representing 24%; forms bond, 20%; envelope, 11% and tablet, 4%. A typical classification of uncoated free-sheet papers by end-use follows:

UNCOATED FREE-SHEET PAPERS CLASSIFIED BY END-USE

Printing/publication
Offset (book)[1]
Lightweight printing[1]
Envelope[1]
Tablet[1]
Cover & text[1]

Business
Forms bond[1]
Copy & reprographic[1]
Carbonless[1]
Mimeograph[1]
Duplicating[1]
Other

Writing
Bond
Cotton fiber[2]

Thin papers
Carbonizing
Cigaret
Condenser

Bristols[2]

1. Conforms to API classification of free-sheet
2. This grade discussed in separate section

OUTLOOK

Hard times arrived for the uncoated free-sheet industry in 1981 after reaching a record 7.98 million-ton production plateau in 1980. In 1981 output only dropped 1.5%, but that followed average annual increases in the 1970s of 4.2%. Order backlogs suffered as customers slashed inventories, responding to high interest rates, and levels of unshipped orders in January 1982 fell below 370,000 tons—in contrast with unshipped orders for more than 800,000 tons in January 1980, and nearly 525,000 tons in January 1981.

At the same time the small number of new machines brought on-line in 1981—capacity grew by only 1.7% over 1980 levels—kept operating rates from falling too far, although they did average just 89.4% for the year compared with 91.2% for 1980. Champion International forecast operating rates for 1982 would average only 88%, bottoming out at 85% in the first quarter and then rising to 93% by year-end.

Both Champion and Mead Corp. pointed to relatively low inventory levels in 1982 as a likely force pushing shipments up in late 1982, and most observers feel that forms bond, bond and reprographic papers will lead a strengthening uncoated free-sheet industry for the next several years. These products will grow at faster rates than the Gross National Product, while envelope, tablet and offset book paper will probably track GNP or grow slightly more slowly.

Then in the mid-decade, however, the industry faces a major jump in capacity which will test companies' marketing adaptability, with at least 640,000 tpy scheduled to come on-line in 1984, in addition to a 200,000-tpy Weyerhaeuser Co. machine planned for some time after 1984 and expansions being considered by others such as Domtar Inc.

INDUSTRY STRUCTURE

U.S. uncoated free-sheet mills are located principally in the Northeast and Midwest but the last 20 years have seen an increasing number of machines added or announced for the South, with Alabama and the Carolinas two of the major centers.

Indeed, since 1975 and including projects announced through 1984, the only major expansions announced outside the South have been a new International Paper machine in Maine in 1977, a 1979 Georgia-Pacific conversion from newsprint, a new Boise Cascade machine in Washington in 1980, a Mead machine starting up in 1982 in Ohio and a Crown Zellerbach machine planned for Washington in 1984. At the same time there have been substantial capacity reductions in the Northeast, along with seven new machines installed in the South, three more announced for 1984, a Weyerhaeuser machine in Mississippi postponed a year or more from 1984, and other machines under consideration.

Recent years have also seen a shift in the industry toward larger machines, with machines over 125,000 tpy rising from 7.5% of industry capacity in 1975 to 16.4% in 1980, while machines of 75,000 tpy and below fell from 72.5% of industry capacity in 1975 to 64.6% in 1980.

At the same time there was a trend towards reduced reliance on purchased pulp, with the percentage of industry capacity represented by integrated mills—mills with active on-site pulpmaking capacity—rising from 64.8% in 1976 to 78.7% in 1980, according to American Paper Institute figures.

Mills in the Northeast and Midwest tend to be smaller in capacity, older, nonintegrated, and equipped with paper machines of 150-in.-trim or less. Many of these mills, of necessity, produce specialty grades that larger mills could not make economically, and also emphasize smaller runs in order to serve the needs of a

ESTIMATED 1982 ANNUAL CAPACITIES FOR MAJOR COMPANIES FOR UNCOATED PRINTING/WRITING GRADES

(000 short tons)

	U.S.	Canada	Total
1. Boise Cascade Corp.	850	—	850
2. Champion International	762	—	762
3. International Paper Co.	675	—	675
4. Great Northern Nekoosa	670	—	670
5. Hammermill Paper Co.	595	—	595
6. Mead Corp	473	—	473
7. Union Camp Corp.	470	—	470
8. Georgia-Pacific Corp.	464	—	464
9. Weyerhaeuser Co.	445	—	445
10. P.H. Glatfelter Co.	430	—	430
11. Domtar Inc.	—	400	400
12. Simpson Paper Co.	340	—	340
13. Eddy Forest Products	60	172	232
14. Finch, Pruyn & Co.	216	—	216
15. Pentair Inc.	190	—	190
16. Fraser	150	40	190
17. Westvaco Corp.	173	—	173
18. Rolland Paper Co.	—	162	162
19. Scott Paper Co.	160	—	160
20. Allied Paper Inc.	150	—	150
21. Wausau Paper Mills	140	—	140
22. Kruger	—	140	140
23. Abitibi-Price	—	125	125
24. Penntech Papers Inc.	120	—	120
25. Potlatch Corp.	113	—	113
26. Sorg Paper Co.	112	—	112
27. Litton Industries Inc.	108	—	108
28. Appleton Papers Inc.	95	—	95
29. Newton Falls Paper Mill	75	—	75
30. Howard Paper Mills	73	—	73
31. Diamond International	70	—	70
32. Great Lakes Forest Products	—	69	69
33. Beckett Paper Co.	53	—	53
34. Lincoln Pulp & Paper	53	—	53
35. Badger Paper Mills Inc.	53	—	53
Other companies	679	95	632
Total	**9,017**	**1,203**	**10,220**

PRINTING/WRITING GRADES[1]: DISTRIBUTION OF MILLS AND PAPER MACHINES BY STATE

				Trims (inches of fourdrinier paper machines					
	No. of mills	No. machines	Daily short tons	under 100	100 to 149	150 to 199	200 to 249	250 to 299	over 300
Alabama	3	6	2,551			2	4		
Arkansas	1	3	940				2	1	
California	3	5	610		4	1			
Colorado	—	—	—						
Connecticut	—	—	—						
Delaware	1	2	20	2					
Florida	—	—	—						
Georgia	—	—	—						
Illinois	1	1	—		1				
Indiana	1	2	—	1	1				
Idaho	—	—	—						
Kansas		—	—	—					
Kentucky	2	2	706				1	1	
Louisiana	2	4	615	1	2			1	
Maine	8	20	2,515	2	10	5	2	1	
Maryland	—	—	—						
Massachusetts	14[2]	31	730	24	7				
Michigan	11	21	1,290	2	15	4			
Minnesota	2	5	351	3		2			
Mississippi	1	1	20			1			
Missouri	—	—	—						
New Hampshire	1	5	550	1	4				
New Jersey	—	—	—						
New Mexico	—	—	—						
New York	8	19	2,112	5	10	2	1	1	
North Carolina	2	6	1,625		1	1	3		1
North Dakota	—	—	—						
Ohio	9	31	2,874	7	21	2			1
Oklahoma	—	—	—						
Oregon	1	3	606			3			
Pennsylvania	8	32	2,357	10	15	7			
Tennessee	1	2	375		1		1		
Texas	1	2	200		2				
Vermont	1	1	200			1			
Virginia	1	4	1,200	1			2		1
Washington	4	8	1,095	1	3	3	1		
W. Virginia	—	—	—						
Wisconsin	14	33	2,218	12	18	2	1		
TOTALS	100	249	25,760[3]	72	115	36	18	5	3
Paper machines: % of total				28.9	46.2	14.5	7.2	2.0	1.2

1. Includes uncoated free-sheet
2. Mills on same site
3. At 350 operating days, capacity of these mills is 9.016 million short tons

wide variety of merchants, printers and other customers.

While this builds customer loyalty, it does little to insulate the mill from some of the other penalties of nonintegration, including the volatility of market pulp prices in times of tight pulp supply. A small number of these mills have experimented with buying deinked pulp or pulp substitutes (white shavings, etc.).

The cost penalty these mills encounter—along with the advantages they enjoy in times of pulp oversupply such as early 1982—is shown in an accompanying table. In 1970 the cost of pulp represented only 33.9% of selling price, whereas in 1980 it had risen to 56.0%. But then in early 1982, with hardwood pulp available at sharp discounts and the list price for pulp unchanged from 18 months earlier, pulp represented only 50.1% of the paper grade's selling price assuming no pulp discount, and a still lower percentage if discounts could be secured. The pulp cost advantage of an integrated mill, $100 in 1980, had probably declined as the pulp market slid.

RISE OF ROLLSTOCK VS SHEET-FED PAPER IN U.S. UNCOATED FREE-SHEET PAPER INDUSTRY

(% of total uncoated free-sheet shipments)

Year	Rolls	Sheets
1980	61%	39%
1975	53	47
1970	45	55
1965	35	65

Source: PULP & PAPER estimates

TYPICAL GRADE STRUCTURE FOR 100% FREE SHEET OFFSET PAPERS

Basis weight (lb, 25 x 38 in., 500 sheets)	Grammage (g/m^2)	Opacity[1] (%)
35	52	82
40	59	86
45	62	87
50	74	89
55	81	91
60	89	90
70	104	92
80	118	94

[1] Government specifications for offset book printing paper; however, these are similar to those used by most companies for high-quality offset with brightness of 80-85

Nonintegrated mills tend to have higher fuel costs since they can't benefit from wastewood to supply biomass boilers or byproduct fuel from kraft liquor. However, being closer to major markets in the North they may have lower transportation costs.

The trend in new capacity has been towards large fourdriniers or twin-wire machines located in southern mills and producing commodity-type grades such as offset paper, forms bond and reprographic paper. These mills use a blend of hardwood and softwood pulps, with hardwood fibers providing desired bulk and printing characteristics and softwood fibers offering strength properties for improved paper machine and printing press runability.

OFFSET PAPERS

Offset papers are generally considered to fall within the family of book papers, a term that can include tablet and envelope paper as well as offset. The common strand running through all these grades is that they are all made to be used for printing and graphic arts purposes, or can be readily produced on the same machines as printing papers. Distinguishing characteristics include surface finish, opacity, brightness and bulk.

Not all offset paper is shipped to book publishers—slightly more than 1.9 million tons of uncoated offset paper was produced in 1981, while total uncoated free-sheet shipments to book publishers reached about 460,000 tons. At the same time, not all paper used to print books is uncoated free-sheet—in 1981, uncoated

FIBER COSTS FOR PRODUCING PRINTING GRADES AT NONINTEGRATED PAPER MILLS

Year	No. 3 offset sheet ($/short ton	Hardwood kraft market pulp ($/short ton)	Ratio of selling prices (pulp/paper)
1982*	878	405	0.461
1981	878	440	0.501
1980	785	440	0.560
1979	714	380	0.532
1978	645	295	0.457
1977	552	250	0.452
1976	506	300	0.592
1975	484	335	0.692
1974	535	335	0.626
1973	457	225	0.492
1972	460	135	0.293
1971	455	135	0.296
1970	442	150	0.339

* 2nd quarter 1982

Source: P&P WEEK; P&P WEEK DATABOOK

free-sheet represented just 56% of the 825,000 tons of paper shipped to book publishers, while uncoated groundwood represented 13% and the coated grades represented another 31%.

Consumption of paper for books tends to track Gross National Product except for recession years, although overall consumption of book papers slipped by 0.2% in 1981—a year when the GNP rose by about 1.5%. This continues a trend begun the year before when shipments fell by about 10%, following an inventory-building 1979. Industry observers expected a modest pickup in late 1982, but feel any growth over the next few years will be slow due to increased competition from coated papers.

Offset and other uncoated free-sheet paper used for other purposes have also lost market share to coated paper as coated paper supply has loosened up. Uncoated free-sheet shipments to commercial printers edged down by 0.6% in 1981 to less than 1.95 million tons, representing 50.0% of all commercial printing papers, while uncoated groundwood was plummeting by 22.0% and coated was jumping by 7.1% to 1.8 million, or about 45.5% of commercial printing shipments.

Offset papers can be sold in rolls or in sheets (cut or folio sizes), and in 1981 the rolls represented about 62% of all offset paper shipments.

Commercial printing press needs dictate that roll diameter and width be standardized, and for stock roll grades, typical diameters are 32-in. and 40-in. Standard widths are 11-, 17-, 22- and 35-in. If nonstocked sizes are ordered, a trim penalty is typically assessed against the purchaser.

Offset and other uncoated book papers are made to run on high-speed offset presses, with the sheet surface sized externally at a size press on the paper machine to prepare the surface for the slight wetness resulting from offset printing. A high degree of resistance to picking is also essential.

Titanium dioxide and other fillers are used to give specific levels of opacity, and a range of qualities and prices is guaranteed by the wide variation in furnish, filler and brightness that is available. Opacified offset paper also has a slightly higher brightness and 2% to 3% higher opacity rating than standard offset book paper. Each mill typically makes a number of grades to meet specific printing-quality and price requirements, so specifications for offset grades can vary. Properties typical for a No. 1-type offset sheet are listed in accompanying table.

One way for mills to offer a lower-priced offset paper is to introduce recycled fiber or mechanical pulp in the furnish, retaining relatively high opacity levels but offering a lower brightness rating. Other variations between uncoated book papers are in bulk and sheet surfaces, with bulk being influenced by changes in basis weight as well as surface treatment. Some common sheet surfaces include antique, eggshell, woven and English.

PRODUCERS OF LWP AND THIN PAPERS

Lightweight printing

Allied Paper Inc.
Jackson Ala.

P.H. Glatfelter Co.
Neenah, Wis.

James River Co.
Kalamazoo, Mich.

Fletcher Paper Co.
Alpena, Mich.

Fraser Paper Ltd.
Madawaska, Maine

Kimberly-Clark Corp.
Lee, Mass.[1]
Neenah, Wis.

Nitec Paper Co.[2]
Niagara Falls, N.Y.

Olin Corp.
Pisgah Forest, N.C.

Port Huron Paper Co.
Port Huron, Mich.

Sorg Paper Co.
Middletown, Ohio

St. Regis Paper Co.
Deferiet, N.Y.

Cigaret

Domtar Inc.
Beauharnois, Que.

Kimberly-Clark Corp.
Spotswood, N.J.[1]
Ancram, N.Y.[1]

Olin Corp.
Pisgah Forest, N.C.

[1] Schweitzer Div.

[2] In the first half of 1982, Nitec went into Chapter 11 and shut down indefinitely.

BASIS WEIGHT AND BULK OF LWP PAPERS

Basis weight (lb, 25x38 in., 500 sheets)	Typical bulk (sheet/in.)
19* (28 g/m²)	1360
20* (30 g/m²)	1290
22* (33 g/m²)	1180
24* (36 g/m²)	1080
26 (38 g/m²)	900/940
28 (41 g/m²)	870/900
30 (44 g/m²	810/850
33 (49 g/m²)	740/790
35 (52 g/m²)	690/700
40 (59 g/m²)	610/640

* Bible grades

LIGHTWEIGHT PRINTING GRADES

Lightweight printing grades represent the bottom end of the printing paper market in terms of basis weight, generally falling under the 40-lb (25x38 in., 500 sheets) range, and being used for products ranging from bibles to business forms. It can be estimated that 911,000 tons of forms bond manufactured in 1980 fell in the 25- to 38-lb (LWP weights) basis-weight range.

Opacity should be at about 85% for LWP grades over 26-lb basis weight, and such papers are heavily loaded with fillers to accomplish this goal. Lighter still are the bible papers, ranging from 19-lb to 24-lb, with opacities of 80% to 85%. LWP papers are favored for some uses in which it is important to reduce the page weight and bulk of books or catalogs.

LWP papers are made from a variety of fibers, including chemical pulps, cotton fiber, flax straw or a combination of these fibers. Production data for these grades is not available.

COVER AND TEXT PAPERS

On the other end of the basis-weight scale are cover and text papers, heavier in weight than offset papers and intended for use as the cover of magazines, pamphlets or paperback books, as well as text pages of such publications. Some cover and text papers can even be as heavyweight as bristols, and are sold in coated as well as uncoated grades. Cover stock can be embossed, coated, plastic-coated or laminated with cloth.

Quality and price are higher than for offset paper. Cover and text papers are made in a variety of colors and finishes, and they are made by the same companies that manufacture offset and bond papers. Bleached board producers such as Federal Paper Board and Temple Eastex also make cover stock, especially coated cover.

Demand for these grades has grown by about 3.1%/year for the last decade although the weak book market of 1981 slowed the growth of this 220,000-tpy market to 1.7% in that year. Cover stock, representing about 35% of the market, did see shipments jump by 6.7%, however. Demand for coated cover and text papers should continue to outpace uncoated due to preference for the higher printing characteristics of coated paper.

BOND, MIMEOGRAPH, DUPLICATING AND COPY (BMDX) PAPERS

The BMDX grades are a natural family, so similar in sheet properties and basis weights that many mills make the same paper for more than one end-use, and mills commonly swing between grades depending on strength of demand for particular products. They are internally and surface-sized since they are also

U.S. PRODUCTION OF UNCOATED COVER AND TEXT PAPERS

(000 short tons)

Year	Cover	% change	Text	% change
1981	75	− 1.3	145	−10.5
1980	76	− 5.0	162	− 0.5
1979	80	8.1	163	18.1
1978	74	8.8	138	13.1
1977	68	19.3	122	2.5
1976	57	32.6	119	5.3
1975	43	−17.3	113	−29.8
1974	52	− 5.5	161	− 2.4
1973	55	12.2	165	13.0
1972	49	14.0	146	5.8
1971	43	—	138	—

Source: PULP & PAPER estimates

COVER AND TEXT PAPERS: TYPICAL GRADE STRUCTURE

Text		Cover	
Basis weight (25x38, 500)	Grammage (g/m²)	Basis weight 20x26, 500)	Grammage (g/m²)
60	53	50	135
65	96	60	162
70*	103	65*	176
75	111	80*	216
80*	118	90	243
100	140	100	270

* Major weights

commonly used for offset printing.

These papers are generally made from 100% chemical pulp, with opacity in the mid- to high-80s and brightness in the low-to-mid-80s. High-quality bond papers are often made with some cotton fiber, and will be discussed in a separate chapter.

Bond papers. The importance of the bond and writing paper market has grown tremendously in the last 20 years. Annual shipments rose from 372,000 tons in 1960 to 1.65 million in 1980, although the market fell off by 5.7% to 1.55 million tons in 1981 as a correction to an excess inventory accumulation in 1980. Bond papers are made in a wide variety of qualities and prices to meet the full range of office and stationery uses, with a typical No. 4 bond (20- to 24-lb) going for $867/ton in the second quarter of 1982, not accounting the $50-and-up discounts then common.

Copy papers. Plain-paper copiers are the dominant type and have reduced coated-paper copiers to a toehold in libraries, schools, drugstores and other low-volume copy sites. Xerox is the best known of the roughly two dozen companies offering plain-paper copiers, and demand for this type of paper is likely to grow dramatically in future years as a result of color copying capabilities, high-speed copiers, intelligent copiers and other developments. Most copiers use cut-size, 8½x11 or 8½x14 in. paper, but a few, such as the IBM Copier II and the Xerox 1860, are roll-fed. High-speed copiers can achieve rates of 120 copies per minute or more, while inexpensive copiers may produce as little as 6 copies per minute. Liquid or dry toners are used.

Plain-paper copy papers are made on the same machines that produce bond and offset papers, have similar characteristics and are produced from chemical pulps. Uniformity of caliper is particularly important for fast copiers, as are stiffness, cleanliness, stacking uniformity and the ability to lay flat.

PAPER SHIPMENTS TO U.S. BOOK PUBLISHERS, 1980-81

(000 short tons)

Grade	1981	1980
Coated two-sides	250	240
C2S Nos. 1-4	165	150
C2S No. 5	85	90
Uncoated free-sheet	460	475
Uncoated groundwood	105	115
Total	**820**	**825**

Source: PULP & PAPER estimates

Uncoated free-sheet represented 99.0% of the 1.4 million tons of printing/writing paper shipped for office reprographic purposes in 1981, but the 14,000 tons of coated paper made for copy purposes was consumed by coated-paper copiers that represent 50% of the number of copy machines installed, by one estimate. Coated-paper copiers tend to be small, slow and low-cost. Papers for such copiers include dielectric and zinc-oxide-coated papers.

Demand for copy paper slipped in 1981 and a further drop was expected in the recession year of 1982, but once economic recovery sets in most observers expect growth rates of about 4% to 5%/year for several years at least. Dielectric paper for nonimpact printers and facsimile transmission will probably show strong demand increases but other coated paper copy demand should be largely stagnant in coming years.

Copy papers as a whole will benefit from the development of the electronic office—a phenomenon which should be understood here to include not just video display terminals and electronic data transmission

COMMON BASIS WEIGHTS FOR BMDX GRADES

Basis weight (17x22, 500)	Grammage (g/m^2)	Bond	Mimeograph	Duplicating	Copy
13	49	X			
16	60	X	X	X	
18	68	X	X	X	
20	75	X	X	X	X
24	90	X*	X		X
28	105	X*			
32	120	X*			
36	135	X*			

* Ledger grades

services, but also a plethora of intelligent copiers that can create forms, print on both sides of paper in a single operation, sort, collate and staple—virtually replacing in-plant printing operations. These systems in many cases, however, are not just replacing in-plant printing one-for-one, with no increase in paper consumption—they are allowing for a dramatic increase in the number of reports, brochures and other documents that can be cheaply and quickly printed by many offices, permitting a significant increase in sales by paper suppliers.

FORMS BOND

Forms bond papers are made to be printed on high-speed, continuous data-processing equipment that employs direct-impact printing methods. The paper itself has qualities similar to those of offset printing papers, and paper mills with the capability to make both grades sometimes switch back and forth in times of market weakness in one grade or the other—as in the poor offset market of 1981 when many mills increased their shipments of forms bond.

Physical requirements for the sheet include good stiffness and strength for fast feeding and printing and for refolding without distortion; a good printing surface which is free of lint; good dimensional stability for perfect register and a high degree of paper cleanliness.

Unlike some uncoated free-sheet papers, forms bond competes directly with lower-priced papers with high groundwood content. Top-quality forms bond is 100% chemical pulp fiber, with a blend of softwood and hardwood kraft pulps common. But some producers add a degree of secondary (recycled) fibers as a cost- and price-cutting measure, or some groundwood pulp to accomplish the same end. Many blended (free-sheet/groundwood) forms sheets are priced as much as 25%

FORMS BOND: TYPICAL GRADE STRUCTURE

Basis weight (17x22, 500)	Grammage (g/m²)
9	34
10	38
12	45
15	53
16	56
18	68
20	75
24*	90
28*	105
32*	120

* Ledger/tag weights

U.S. PRICES FOR UNCOATED WHITE PAPER

($ per short ton)

	Bookpaper No. 3 offset +45-lb sheets	Bond, No. 4 unwatermarked 20-24-lb sheets	No. 1 watermarked +20-lb sheets	Forms bond 15-lb rolls	Bond 25% cotton sheets
1982 2nd quarter	878	867	916	753	1650
Year-end					
1981	878	867	916	753	1650
1980	813	803	848	697	1490
1979	711/717	720	778	620	1309/1343
1978	645	640/644	695	538/550	1190/1230
1977	548/555	548/590	645/650	450/500	1143
1976	506	561	628	519/520	1083
1975	484	550	605	495/504	1012
1974	535	559	637	470	984
1973	457	495	n.a.	n.a.	734
1972	460	470	n.a.	n.a.	728
1971	455	460	n.a.	n.a.	719
1970	442	445	n.a.	n.a.	n.a.

Source: P&P WEEK

below free-sheet bond, while the primarily-groundwood forms papers are priced at around 50% below free-sheet prices.

Leaders in free-sheet forms bond include Boise Cascade, International Paper, Mead and Georgia-Pacific, while G-P has been a pioneer in blended bonds and Abitibi-Price and Great Northern Nekoosa are leaders in groundwood forms paper. The groundwood product is often not surface-sized, sacrificing printing press runability and printability, and has lower brightness and opacity than the free-sheet product, but has a considerable price advantage. Typical uses are for internal record-keeping where appearance is not important. Blended bonds, on the other hand, are often surface-sized and may have a good appearance as well, offering an attractive middle road between the two extremes. In times of free-sheet discounting, however, the blended product seems to have a tendency to get squeezed out.

Abitibi-Price and others making groundwood forms paper are said to be working hard to improve the quality of the sheet so that it will be able to run successfully through high-speed printers, and a marketing executive with a company making blended bonds said he considers such a product to be among his biggest single competitive worries since it would remove an important advantage of blended bonds.

BUSINESS FORMS: VALUE OF U.S. SHIPMENTS

($ million)

	1977	1972
Unit sets	891.6	514.2
Manifold books	129.2	51.5
Custom continuous forms	923.0	553.6
Stock continuous forms	604.9	204.9
Others	172.5	57.7
TOTAL	2721.2	1381.9

Source: 1977 Census of Manufacturers

Uncoated free-sheet bond represented 89% of all shipments to business forms converters in 1981, while uncoated groundwood, at 248,000 tons, made up only 11%. But the groundwood segment is growing much faster—16% in 1981 alone, in contrast with a 5.4% increase for uncoated free-sheet bond—and is widely expected to eventually capture perhaps as much as 20% of the market. Carbonless paper forms are also used for multi-part continous forms.

U.S. PRODUCTION AND CAPACITY OF UNCOATED WOODFREE PAPERS*

(000 short tons)

	Production[1]	% change	Capacity[2]	% change
1984e	—	—	9532	4.5%
1983e	—	—	9123	1.2
1982e	—	—	9017	2.6
1981	7814	−2.4%	8791	1.7
1980	8008	4.6	8645	6.8
1979	7655	4.6	8095	3.1
1978	7315	3.9	7847	5.1
1977	7036	9.4	7465	2.0
1976	6430	22.6	7319	1.9
1975	5243	−18.8	7180	1.9
1974	6457	0.1	7046	7.7
1973	6450	9.5	6541	5.5
1972	5886	10.0	6198	7.2
1971	5349	3.3	5780	1.3
1970	5177	−0.8	5702	0.3
1969	5222	—	5681	—
Average 1971-81		4.3		4.0

e P&P estimate

* Excluding cotton fiber, bristol, and thin paper

1. Source: Bureau of Census

2. Source: American Paper Institute

CARBONIZING TISSUE PRODUCERS

1. Burrows Paper Corp.
   Little Falls, N.Y.
2. Consolidated-Bathurst Inc.
   Trois Rivieres, Que.
3. Crane & Co. (1100 tpy)[1]
   Old Berkshire Mill,
   Dalton, Mass.
4. Domtar Inc.
   Fine Papers Div.
   St. Catharines, Ont.
5. Dunn Paper Co.
   Port Huron, Mich.
   Wiggins, Miss.
6. Fletcher Paper Co.
   Alpena, Mich.
7. Fraser Paper Ltd.
   Madawaska, Maine
8. International Paper Co.
   Jay, Maine
9. James River-Otis Inc.
   Jay, Maine
10. Miami Paper Co.
    (Subsidiary of Pentair)
    West Carrollton, Ohio
11. Olin Corp.
    Ecusta Paper Div.
    Pisgah Forest, N.C.
12. Port Huron Papers
    Port Huron, Mich.
13. Seaman Paper Co. of Mass. Inc.
    Otter River, Mass.
14. Chagrin Fibers Inc.
    Norfolk, N.Y.
15. Thilmany Pulp & Paper Co.
    (Div. of Hammermill)
    Kaukauna, Wis.

[1] Approximate carbonizing tissue capacity

Another development affecting the forms bond industry in recent years, in addition to competition from groundwood forms paper, has been a slow but steady rise in basis weights, due in part to the increased preference for heavy-weight single-part forms as opposed to light-weight multi-part forms. One executive cited a study that showed the average basis weight of U.S. forms bond production rose from 15.1-lb in 1972 to 16.1-lb in 1980, with the 10- to 14-lb range falling from 34.3% of all forms bond in 1972 to 21.1% in 1980. In that time the 16- to 25-lb paper rose from a 21.9% market share to 39.7%.

A further major factor for forms bond has been the jump in the number of small personal and business computers installed in recent years. Such computers, along with word processors, use both stock continuous forms and cut-size paper, and their projected popularity will guarantee a healthy growth rate for forms bond in coming years. Most observers expect a growth rate through 1985 of 4% to 5%, after a more nearly flat performance in 1982.

Forms bond capacity has been relatively flat in recent years, with only one new machine coming on-line recently: Willamette Industries' 100,000-tpy Hawesville, Ky., unit, on-stream in late 1981. Several new machines coming on-line in 1984 will be able to make forms bond as well as other uncoated grades, and an increasing customer acceptance of groundwood forms would find several Canadian newsprint manufacturers ready and eager to switch old newsprint machines over to produce such a product. With projected healthy growth in demand, however, mills should for the next few years be able to pass along cost increases more easily than in some other uncoated free-sheet grades—offset and tablet stock in particular.

CARBONLESS PAPER

Carbonless paper has increasingly replaced carbon paper in uses for which an image must be transferred by impact or pressure to a second piece of paper. Common end-uses are business forms, order books,

CARBONLESS BASE STOCK AND CARBONIZING TISSUE PRODUCTION

(000 short tons)

	1982e	1981	1980
Carbonizing	165	180	181
Carbonless	300	320	295

Source: P&P estimates

receipts and so on. The image is transferred from the top or "donor" sheet to succeeding sheets with the aid of an encapsulated dye coated onto the back side of the paper. When the top surface is imprinted, the pressure breaks the dye on the back and the image is transferred to the top of the next sheet. The receiving side is coated with kaolin clay to enhance the sharpness of the received image. Up to five replicas can be made.

The basestock (CB) for a carbonless form is produced from high-quality chemical pulps, using a standard fourdrinier paper machine, with the receiving sheet being coated on the paper machine and the stock then going to an off-machine coater for the encapsulated dye. When more than two sheets are desired for a set of forms, the intermediate sheets (CFB) are coated on the front with kaolin and on the back with dye. The last sheet (CF) is coated on the front but not on the back, with a top coating to receive the image.

Production figures for carbonless forms are not published and are nearly impossible to come by, but one executive with a company making the product estimates total U.S. production at about 250,000 tons in 1981, while one-time carbonizing paper production in the U.S. in 1981 was under 180,000 tons.

Appleton Papers is the leader in carbonless forms basestock, with Mead Corp. also a force in the market. Appleton is also a major converter, and as such converts the basestock into forms by applying the dye on off-machine coaters and then rolls the paper into sets. Other major converters include 3M Co. and Nashua Corp. Recently Mead offered a process, called OPAS, of producing carbonless forms at printing plants by modifying existing offset presses, thus allowing printers to expand their use of carbonless paper.

THIN PAPERS

Thin papers bear a resemblance to tissue paper and are used to produce a variety of products, such as carbonizing tissue, cigaret and condenser papers and other papers for specialized uses (lens cleaning and stencils are two such minor uses).

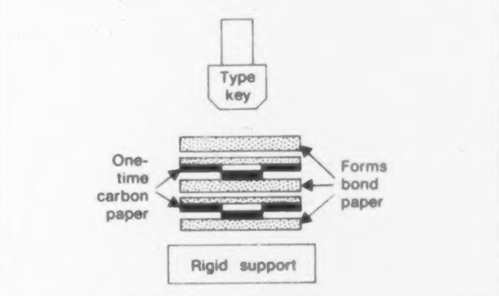
Carbonizing is the major product, with carbon black or pigments being coated onto a bleached or unbleached basesheet by a converter and then combined with a bond sheet to form one-time carbon paper. One-time carbon forms are used in over half of all multi-part forms, despite inroads from carbonless forms, but the market shift toward continuous forms—and especially continuous forms produced on office computers and intelligent copiers capable of generating a form and filling it in, using a blank roll of forms paper—has eroded the share of the forms market represented by multi-part forms from about 45% in 1970 to about 35% in 1980.

Basis weights range widely but a typical weight (20x30 in., 500 sheets) would be 8.65 lb. The sheet is made on a yankee fourdrinier paper machine at medium speeds of around 2000 fpm, with chemical furnish being used, refined to form a tight sheet devoid of pinholes.

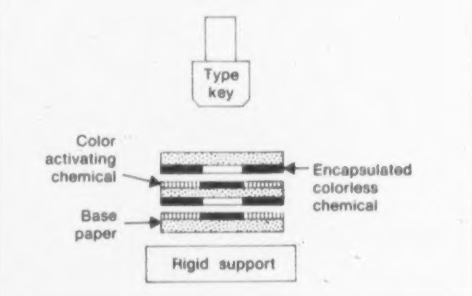
Other important thin papers include cigaret paper, a strong, highly filled lightweight product made largely from flax straw. The paper is heavily filled with precipitated calcium carbonate to give a controlled burning rate. Principal producers in the U.S. are Olin Corp.'s Ecusta Paper Div. and Kimberly-Clark Corp.'s Schweitzer Div.

Electrical papers include a number of grades such as insulating, condenser, capacitor and dielectric, with condenser and capacitor papers falling under the thin paper classification. Reliable estimates of production are not available but PULP & PAPER believes they total considerably less than 20,000 tpy between them. Some electrical papers, such as insulating paper, are listed under "special industrial papers" and their tonnages are not included in these estimates. They are discussed elsewhere in this book.

ONE-TIME CARBON AND FORMS BOND PAPER



CARBONLESS PAPER FORM



TYPICAL BULKS FOR BOOK PAPERS AT DIFFERENT BASIS WEIGHTS AND SHEET FINISHES

		Standard bulks		
Basis weight (25 x 38, 500)	**Antique (ppi)***	**Eggshell (ppi)**	**Standard (ppi)**	**Eng. finish (ppi)**
45	—	492	540	600
50	410	440	488	540
55	360	386	444	500
60	330	364	408	440
70	288	316	350	390

* ppi = pages (sheets) per inch

Source: International Paper Co.

NEW U.S. AND CANADIAN UNCOATED FREE-SHEET CAPACITY THROUGH 1985

Announced projects	Location	Annual short tons	Startup
United States			
Crown Zellerbach[2]	Clatskanie, Ore.	30,000	1982
Champion[1]	Courtland, Ala.	145,000	1983
Crown Zellerbach[1]	Camas, Wash.	160,000	1984
International Paper	Georgetown, S.C.	120,000	1984
Union Camp[1]	Eastover, S.C.	210,000	1984
Georgia-Pacific[1]	Port Hudson, La.	138,000	n.a.
Champion[1]*	Halifax, N.C.	n.a.	n.a.
Hammermill/ Strathmore[2]*	Westfield, Mass.	12-15,000	n.a.
Weyerhaeuser[3]*	Columbus, Miss.	200,000	n.a.
Canada			**metric tons**
Great Lakes Paper[1]	Dryden, Ont.	122,000[4]	1983
Domtar[1]*	Windsor, Que.	n.a.	n.a.
MacMillan Bloedel[1],[3]	New Westminster, B.C.	75,000	n.a.
Makin Project Ltd.[1]*	Red Deer, Alta.	43,500	n.a.

* Under study—not formally approved
1. New machine
2. Speedup or modernization
3. Postponed indefinitely but not cancelled
4. Replaces three machines; net increase is 59,000 metric tpy

Source: PULP & PAPER WEEK, PULP & PAPER PROJECT REPORT

COTTON-FIBER PAPER

Cotton-fiber papers, which contain anywhere from 25% to 100% cotton fiber, are used as high-quality bond papers, technical papers and for other special uses where permanence and durability are required—such as paper currency, financial certificates and postage stamps.

The "rag content" in the pulp used to make these papers generally comes from (1) new cotton cuttings from the textile and garment industry (and formerly old rags) and (2) from linters. Cotton linters are the short fibers adhering to cotton seed after the ginning operation and consist of the stumps or bases of the longer staple textile fibers and short fuzz fibers. The cotton cuttings from new cotton fabrics are generally classified according to textile source—unbleached muslin white shirt cuttings, light prints, blue denims, etc.

Cotton, either in the form of staple fiber used in the textile industry or in the form of cotton linters, is the purest natural form of cellulose (98% to 99% alpha content) and gives cotton-content paper its durability. The cotton fibers used in cotton-content papers are usually blended with sulfate or sulfite woodpulps. The blended pulp is highly refined or beaten to develop a sheet with crackle and good strength. It is sized internally (beater sizing) to produce a proper level of holdout to inks. When a cockle finish is desired, the sheet is air-dried.

Competition for cotton fibers from clothing and other industries has reduced availability of 100% cotton scraps, and made 100%-cotton bond scarce and expensive. Sulfite bond has been used as a substitute because of its purity and permanence compared to sulfate papers.

Cotton-content papers are sometimes watermarked to leave an impression on the sheet. However, demand for watermarked sheets has been diminishing in recent years, because of the high production costs involved. Watermarking is done using a dandy roll in which a raised impression has been made. The dandy roll presses on the wet web as it is carried along on the fourdrinier wire. The fibers in the area of the raised impression are separated, making that area of the sheet thinner in the design of the watermark.

COTTON-CONTENT PAPERS: GRADE DISTRIBUTION

(short tons)

	1978	1979	1980
TOTAL writing, cotton fiber	119,204	130,286	130,823
Bond and writing	85,547	91,389	92,876
Ledger	4,571	4,251	3,918
Onionskin and manifold	3,046	3,516	3,053
Papeterie and wedding	2,591	3,019	2,982
Body stock[1]	3,475	9,125	9,674
Other technical[2]	8,519	8,412	8,441
Index	3,381	3,238	2,976
Other	8,074	7,336	6,903

1. For communication, copying and related papers
2. For technical and reproduction papers

Source: Bureau of the Census

The older watermarking method involved soldering wires to the surface of the dandy roll in the pattern desired. This was extremely costly, and has been generally replaced with an embossing process. In this process, the pattern is stamped into the dandy wire before it is wrapped around the roll.

Cotton-content papers are generally sold n a range of basis weights: 9, 13, 16, 20 and 24 lb (17x22 in., 500 sheets). They are also labeled according to sheet finishes such as light cockle, cockle, smooth, vellum, and linen. In addition, they are categorized according to their colors and sheet properties (which include whiteness, opaque, onionskin).

Production of cotton-content papers has been relatively static in recent years. U.S. production in 1978 was 119,000 tons. Output rose to 130,000 tons in 1979 and 131,000 tons in 1980, but then fell to 119,000 tons in 1981.

Cotton-fiber papers appeared to be weathering the 1982 recession fairly well with shipments for the first five months of 1982 0.6% higher than in the same period in 1981, while production for the overall printing and writing paper market recorded a drop of 3%. Cotton-fiber bond and writing papers jumped 4.6% in the first five months of 1982, with the 25%-cotton bond being up 12.5%—although 100%-cotton bond dropped 21% to an annual rate of about 10,000 tpy.

Pricing also was strong for cotton-content papers in the first half of 1982. A 6.5% price hike that went into effect November 1981 for U.S. customers and December 1982 for Canadian buyers, was one of the few price increases which was holding firm in mid-1982.

Pricing for cotton-fiber papers has been aggressive in recent years, although this was partly necessary to offset rapidly rising costs for cotton cuttings and linters. Since 1974, the price of 25%-cotton-content bond paper has risen 68%. The price escalation has probably caused some users to switch to other grades of printing and writing papers, but overall, sales have remained strong.

Only about 20 companies, with small mills mainly in the Northeast and upper Midwest, produce any significant tonnage of cotton-fiber papers. Because most of these mills can also produce bond-type grades from 100%-chemical-pulp furnish, production is controlled mainly by demand rather than capacity.

Capacity for these grades has decreased gradually from 159,000 tons in 1969 to 142,000 tons in 1982, according to American Paper Institute data.

NORTH AMERICAN PRODUCERS OF COTTON-CONTENT PAPERS

Capacity[1] Company/mill	(tons/day)
1. Beckett Paper Co., Hamilton, Ohio[2]	142
2. Crane & Co. Inc., Dalton, Mass.	130
3. Curtis Paper Co., Newark, Del.[3]	24
4. Domtar Inc. Fine Paper Div., Beauharnois, Que.	40
5. Eastern Fine Paper Inc., Brewer, Maine[4]	180
6. Esleeck Mfg. Co., Turners Falls, Mass.	18
7. Fletcher Paper Co., Alpena, Mich.	82
8. Gilbert Paper Co., Menasha, Wis.[5]	85
9. Howard Paper Mills Inc., Dayton, Ohio	125
10. Harding-Jones Paper, Middletown, Ohio	22
11. James River-Fitchburg Inc., Fitchburg, Mass.[3]	60
12. Kimberly-Clark Corp., Neenah, Wis.[6]	130
13. Millers Falls Paper Co., Millers Falls, Mass.	30
14. Monadnock Paper Mills, Bennington, N.H.	75
15. Parsons Paper, Holyoke, Mass.[7]	32
16. Rising Paper Co., Housatonic, Mass.	50
17. Sorg Paper Co., Middletown, Ohio	300
18. Southworth Co., W. Springfield, Mass.	20
19. Strathmore Paper Co., Turners Falls, Westfield and Woronoco, Mass., mills[2]	85
20. Byron Weston Co., Dalton, Mass.[8]	41.

1. Total mill capacity, including fine paper
2. Div. of Hammermill
3. Div. of James River Paper Co.
4. Affiliate of Eddy Paper Co. Ltd.
5. Div. of Mead Corp.
6. Includes Plover mill in Stevens Point, Wis.
7. Div. of NVF Co.
8. Sub. of Crane & Co. Inc.

PRICING TRENDS FOR BOND PAPERS

($/short ton)

Year-end	Forms bond[1]	25% cotton[2]
1982[3]	753	1650
1981	753	1549
1980	697	1490
1979	620	1343
1978	544	1210
1977	475	1143
1976	520	1083
1975	500	1012
1974	470	984
1973	—	728
1972	—	719

1. Average price for rolls
2. Average price for sheets
3. As of June 1982

BRISTOLS

GRADE STRUCTURE

Bristols are bleached or semibleached kraft paper, slightly lighter than bleached boards but heavier than true printing and writing grades, usually with a thickness or caliper of 0.006-in. or more.

Included in the bristol grades are tabulating index, tag and file folder, index bristols, printing bristols, postcard, and coated bristols, as well as mill or "bogus" bristols, which are bristol-type recycled paperboards made on cylinder paper machines.

Tabulating stock is used primarily for computer tab cards and must have superior dimensional stability and electrical characteristics. It is produced on fourdrinier paper machines from semibleached kraft pulps.

Printing bristols are used in a variety of ways, and can either be coated on one-side or uncoated. Many have characteristics similiar to cover grades. Lower-caliper (below 0.015 in.) coated bristols are produced on fourdrinier paper machines from a blend of bleached hardwood and softwood kraft pulps. Hardwood improves the printing surface and adds bulk.

Mill bristols extend the availablility of printing bristols to calipers of 15 points and higher. They are produced by a number of companies making specialty paperboard.

Index bristols have a fairly good printing surface that is extremely erasable. Both tag and index bristols are normally produced on fourdrinier paper machines. Although both grades are similiar, tag bristol is stronger and more durable.

OUTLOOK

Bristols markets are generally considered to be mature and not much growth in any of the end-uses is expected in the next few years. Overall, the market is expected to remain relatively flat or decline slightly.

The one bright spot in the market appears to be in direct-mail advertising and commercial printing demand. Production of printing bristols in 1982 was expected to increase to 56,000 tons from 39,000 tons in 1981. This is expected to take up some of the slack demand for other grades, such as tabulating index.

Tabulating index, or tabcard stock, has declined dramatically since 1970—with output falling by nearly 75%—due to the drop in computer systems requiring tab cards. Demand for this grade is expected to continue to drop because newer computers are based on tape or disc input.

Orders for bristol grades used in offices, such as folders and index stock, should also drop slowly in the future as computerized file systems replace traditional record-keeping methods. Production of folder stock, which has increased nearly 74% since 1970, was

U.S. STATISTICS FOR BRISTOLS

	1980	1981	1982e
Production[1], 000 tons†	960	984	900
Capacity[2], 000 tons	1024	1060	1088
Utilization rate,%	93.8	92.8	82.7
Imports, tons	1100	910	992
Exports, 000 tons	8.8	6.4	7.2
Apparent U.S. consumption			
000 tons	952	979	894
lb/capita	8.4	8.5	7.7
000 tons/$ billion real GNP (1972)	.64	.65	.60

1. Bleached bristols, Census data
† All tons are short tons
2. Bleached bristols, API data
e = Pulp & Paper estimate

expected to decline slightly in 1982 to 125,00 tons from 127,000 tons in 1981.

Despite a gloomy outlook for the overall bristols market—production is expected to drop about 8% in 1982 from 1981—a limited capacity should maintain a relatively healthy operating rate in the industry. Capacity increases have been gradual and slight in recent years following declines in the 1970s that kept the market tight. In 1979, when capacity fell to a low of just over a million tons, the operating rate reached a high of 104%. In 1984, capacity is expected to reach 1.155 million tons and the operating rates should be about 93% or 94%, industry executives believe.

Bristol capacity is somewhat hard to pinpoint, however, because of the confusing delineation between bristols and other grades, including uncoated free-sheet, bleached board, cover/text, and boxboard. Most industry executives suspect that bristol capacity is somewhat higher than officially reported.

Bristol pricing has been aggressive historically, helped along by high operating rates. During the recession of 1981-82 bristol grade pricing held up relatively well compared to the heavy discounting in some other sectors of the industry, and some price

BRISTOLS: TYPICAL GRADE STRUCTURE

Grade	Uses, basis weight ranges	
INDEX: (uncoated)	Sales lists, manuals, record folders, file cards	
	Basis:	25½x30½ in., 500
	Weights:	80 lb (145 g/m²)
		90 lb (163 g/m²)
		110 lb (199 g/m²)
		140 lb (253 g/m²)
		170 lb (307 g/m²)
		220 lb (398 g/m²)
TAG: (uncoated)	Tags, ruled forms, timecards, menus, folders, catalog inserts, display cards	
	Basis:	24x36 in., 500
	Weights:	90 lb (146 g/m²)
		100 lb (163 g/m²)
		125 lb (203 g/m²)
		150 lb (244 g/m²)
		175 lb (285 g/m²)
		200 lb (325 g/m²)
POSTCARD[1]: (uncoated)	Return mailers, bills/statements	
	Basis:	22½x28½ in., 500
	Weights:	57 lb (125 g/m²)
		67 lb (147 g/m²)
		80 lb (176 g/m²
MILL BRISTOLS[2] (uncoated or coated 1-S)	Promotional folders, posters, point-of-purchase displays, tent cards, covers, etc.	
	Caliper:	0.080 in.
		0.010 in.
		0.012 in.
		0.015 in.
		0.018 in.
		0.020 in.
		0.024 in.

1. Approximate calipers: 0.009 in. for 67 lb, 0.0075 in. for 57 lb
2. A wide range of grades, including bogus bristols. The higher-caliper grades, above 15 pt, could be produced on cylinder machines. Also available in higher calipers

PRODUCTION TRENDS FOR BLEACHED BRISTOL

(000 short tons)

		Grades		
	Total	Tabulating index	Other uncoated	Coated
1981	984	471	238	275
1980	960	476	250	234
1978	1127	593	229	272
1977	1034	572	209	252
1976	1012	599	203	209
1975	936	594	169	173
1974	1185	712	254	218
1973	1209	796	190	223
1972	1062	768	156	138
1971	976	735	135	106
1970	997	771	137	88

Source: Bureau of the Census

BLEACHED BRISTOL PRODUCTION —BY GRADES

(000 short tons)

	1970	1981	1982e	% change (1970-82)
Total	1077	776	724	−32.8
Tabulating	500	142	127	−74.6
Tag	186	194	172	− 7.5
Folder	72	127	125	+73.6
Index	102	123	112	+ 9.8
Printing	32	39	56	+75.0
Postcard	7	1.4	0.9	−87.1
Coated	179	290	167	− 6.7

e = Pulp & Paper estimate

increases went through in early 1982 at a time when almost no other printing/writing grades were going up in price.

Bleached bristol production during 1981 had been ahead of year-earlier levels. A number of solid bleached board machines had been switched to produce bristols because of weakness in SBS markets in 1982. They were reportedly being switched back to making SBS later in 1982, however, because of weakness in bristol markets.

PRODUCERS OF BRISTOL GRADES

Mill*

Beveridge Paper Co.[1]
Indianopolis, Ind.

Byron Weston Co.[2]
Dalton, Mass.

Foster Paper Co.
Utica, N.Y.

Lowe Paper Co.
Ridgefield, N.J.

Saxon Industries Inc.
Sheldon Springs, Vt.

Sonoco Products Co.
Holyoke, Mass.

Index/printing

Boise Cascade Corp.
Brownsville, N.Y.
Beaver Falls, N.Y.

Champion International
Hamilton Ohio,

Diamond International
Hyde Park, Mass.

Domtar Inc.
Cornwall, Ont.
St. Catharines, Ont.
Toronto, Ont.

Eddy Forest Products
Brewer, Maine

Fox River Paper Co.
Appleton, Wis.

Gilbert Paper Co.[3]
Menasha, Wis.

International Paper Co.
Bastrop, La.
Moss Point, Miss.

James River-Fitchburg
Fitchburg, Mass.

Kimberly-Clark Corp.

Neenah, Wis.

Mohawk Paper Mills Inc.
Cohoes, N.Y.
Waterville, N.Y.

Plainwell Paper Co.
Plainwell, Mich.

Riegel Products Corp.
Warren Glen, N.J.

Rising Paper Co.
Housatonic, Mass.

Tag

Boise Cascade Corp.
Brownsville, N.Y.
Beaver Falls, N.Y.

Domtar Inc.
Toronto, Ont.

International Paper
Bastrop, La.
Georgetown, S.C.

James River-Fitchburg
Fitchburg, Mass.

MacMillan Bloedel Ltd.
New Westminster, N.C.

Merrimac Paper Co.
Lawrence, Mass.

Potlatch Corp.
Lewiston, Idaho

Riegel Products Corp.[6]
Warren Glen, N.J.

Rolland Paper Co. Ltd.
Mont Rolland, Que.

Saxon Industries Inc.
Sheldon Springs, Vt.

Simpson Paper Co.
Miquon, Pa.

Sorg Paper Co.
Middletown, Ohio.

Temple-Eastex Inc.
Evadale, Texas

Union Camp Corp.
Franklin, Va.

Postcard

Diamond International
Hyde Park, Mass.

Domtar Inc.
Cornwall, Ont.

Eastern Fine Paper Inc.
Brewer, Maine.

Hennepin Paper Co.
Little Falls, Minn.

International Paper Co.
Mobile, Ala.
Ticonderoga, N.Y.

Lowe Paper Co.
Ridgefield, N.J.

Pejepscot Paper
Brunswick, Maine.

Riegel Products Corp.
Hughesville, N.J.

Sorg Paper Co.
Middletown, Ohio

Wausau Paper Mills Co.
Brokaw, Wis.

Continued on next page

PRODUCERS OF BRISTOL GRADES, continued

Mill*	Index/printing	Tag	Postcard
	Rolland Paper Co. St. Jerome, Que.		
	Scott Paper Co. Mobile, Ala.		
	Simpson Paper Co. Vicksburg, Mich. Miquon, Pa.		
	Sorg Paper Co. Middletown, Ohio		
	Strathmore Paper Co.[4] Westfield, Mass.		
	Temple-Eastex Inc. Evadale, Texas		
	Union Camp Corp. Franklin, Va.		
	Wausau Paper Mills Co. Brokaw, Wis.		
	Whiting Paper Co. Menasha, Wis.		

* Includes bogus bristols and heavyweight bristols from bleached kraft used for posters, etc.

1. Sub. of Simkins Industries Inc.
2. Sub. of Crane & Co. Inc.
3. Div. of Mead Corp.
4. Div. of Hammermill Paper Co.
5. Div. of Hearst Corp.
6. Sub. of James River Corp.

CAPACITY TRENDS FOR BLEACHED BRISTOLS

	Annual capacity (000 short tons)
1984	1155
1983	1127
1982	1088
1981	1060
1980	1024
1979	1020
1978	1194
1976	1165
1974	1235
1972	1155
1970	1112
1969	1047

Source: American Paper Institute

PACKAGING AND INDUSTRIAL CONVERTING

GRADE STRUCTURE

Packaging and industrial papers include a wide range of unbleached and bleached grades, divided into three general categories: (1) unbleached packaging and industrial converting grades such as wrapping, shipping sack, bag and sack, and other converting papers 18-lb and over; (2) bleached packaging and industrial converting grades; and (3) special industrial papers such as absorbent, cable, electrical and vulcanized fiber paper. The bleached grades also include glassine, greaseproof and parchment papers.

Unbleached grades account for close to 70% of total production, with bleached grades slightly more than 20% and special industrial around 10%. Demand for specific unbleached and bleached end-uses: bag and sack, 43%; shipping sack, 22%; wrapping, 5%; other converting 15%; glassine, greaseproof, parchment, 5%; and special industrial, 10%.

Kraft packaging and industrial converting papers are normally divided into four end-uses: (1) wrapping, (2) shipping sack, (3) bag and sack, and (4) converting papers. These grades are produced from unbleached kraft pulp, principally from softwoods, on fourdrinier paper machines. Unbleached kraft papers are characterized by high strength properties and the sheet surface is normally smoothed by calendering (MF, machine finish) or by yankee dryer (MG, machine glazed).

Kraft papers for bag and sack are made in a range of basis weights, 30 to 80 lb/3000 ft^2 or 49 to 130 g/m^2. Unbleached kraft paper for grocery bags is made at weights of 30 lb to 40 lb, in 5-lb increments, whereas grocery sack paper is made in higher weights. Typical weights are 40, 52, 57, 65, 70, 75 and 80 lb. The most popular weights are in the 51-75 lb range. As a general rule, sack paper is made in weights of 40 lb or heavier.

If higher strength or toughness is required, extensible kraft papers are offered but these papers are primarily made form multi-wall bags and specialty papers. Paper capacity for extensible paper is estimated to be about 200,000 tons.

Bags are primarily made in four designs: (1) flat, (2) square, (3) satchel-bottom and (4) self-opening.

Since bags are made for many types of uses and in various sizes, paper stock requirements vary in weight and treatment and are tailored to each end-use. Most unbleached kraft papers are consumed in producing grocery bags and sacks.

Sacks are larger bags, usually the large size bags used by grocery stores and for packaging individual products such as dog food or sugar. Sacks are standardized in four sizes (1/8, 1/6, 1/5, and 1/4 of a

U.S. STATISTICS FOR PACKAGING AND INDUSTRIAL CONVERTING PAPERS

	1982e	1981	1980
Production[1], 000 tons	5250	5550	5571
Capacity[1], 000 tons	6140	5947	6072
Utilization rate, %	85.5	93.3	91.7
Imports, 000 tons	74	94	86
Export, 000 tons	285	303	331
Apparent U.S. consumption			
000 tons	5039	5341	5326
lb/capita	43.50	46.50	46.78
000 tons/$ billion real GNP (1972)	3.41	3.55	3.61

1. American Paper Institute data. All tons short.
e = estimated

bushel). Normally a heavier-weight kraft paper is used than with bags—40 lb to 80 lb, or 65 to 130 g/m^2. Sacks are divided into four classes: single-wall, heavy single-wall, double-wall or duplex, and multi-wall.

Merchandise bags are smaller and more specialized types of bags, primarily used by nongrocery retail stores, such as department stores. Commonly, these are bleached and printed.

Multiwall sacks, or shipping sacks, are heavy-duty bags used to ship bulk products such as cement, chemicals, and agricultural products. Multiwall sacks are made up of two or more plies of sack paper. Sack papers are commonly laminated or coated with plastic film. There are two different paper weights that are used—50 and 60 lb.

CURRENT MARKET TRENDS

Production of packaging and industrial converting grades has remained relatively flat over the past decade. reaching a peak of 5.9 million tons in 1979 and then declining to 5.6 million tons in 1981, according to Bureau of Census data. Competitive inroads by plastic films into many packaging and industrial converting paper markets and more recently the recession have caused the flat to declining trend in demand.

Unbleached kraft paper production has shown even greater weakness, peaking at 4.2 million tons in 1974 and declining to 3.9 million tons in 1981 with a further 6% to 7% decline likely for 1982.

Multiwall shipping sack paper output has been hurt by the depressed state of construction and agricultural markets. Grocery bag and sack paper demand has been more stable, but there has been oversupply caused by machines swinging from linerboard into heavyweight kraft paper. Estimates place the amount of such swing capacity in the industry at around 1 million tons.

The weak market conditions have caused some price discounting on multiwall paper and even fiercer price cutting on grocery sack paper—making the latter grade highly unprofitable for most producers.

Despite the declining trend in production, operating rates for unbleached kraft paper mills have remained relatively high because of limited capacity expansion and shutdown of older facilities. In 1978 Gulf States Paper closed its 175,000-tpy unbleached kraft pape mill at Tuscaloosa, Ala., followed by the phaseout of 140,000 tpy of kraft paper at Crown Zellerbach's Bogalusa, La., mill and the shutdown of Boise Southern's 106,000-tpy Elizabeth, La., mill. Weyerhaeuser also shut down two machines at Rothschild, Wis., which were making 42,000 tpy of bleached packaging paper.

St. Regis Paper in late 1981 started up a new 235,000-tpy unbleached kraft paper machine at its Pensacola, Fla., mill but this additional capacity has been partially offset by conversion of a 100,000-tpy kraft paper machine to newsprint at the company's Houston, Texas, mill and the planned conversion of a 90,000-tpy unbleached kraft paper machine at Pensacola to bleached paperboard.

OUTLOOK BY END-USES

Grocery and other bag and sack paper. The largest end-use market for kraft packaging paper has been fairly stable over the past decade and in 1981 totaled 2.2 million tons. This has mainly been due to the fact that until recently plastic has been unable to penetrate the grocery carryout sack market, which has been showing moderate growth and in 1981 consumed about 1.2 million tons of unbleached kraft paper.

But plastics now appear poised to make significant inroads into the U.S. grocery sack market mainly as a result of two developments. The first is the widespread availability of a new generation of polymers such as linear low-density polyethylene (LLDPE) and high-molecular-weight high-density polyethylene (HMW) which make it possible to downgage sack walls by as much as 35% to 50% over conventional low-density polyethylene (LDPE). Secondly, overcapacity and fierce price competition among resin producers have caused the price of LDPE to drop as low as 28¢/lb in 1982 compared with previous list prices of 41¢/lb.

These developments have enabled plastic bags—often LDPE/LLDPE blends in a "tee-shirt" design with strap handles—to compete in price with kraft grocery sacks. Plastic bags captured about 5% of the U.S. grocery sack market in 1981 and some forecasters project they could grab as much as 25% by the mid-1980s, displacing around 350,000 tons of unbleached kraft paper. In Canada, plastic bags have already captured an estimated 40% to 50% of the grocery sack market despite the fact that resin costs were higher when most of this penetration occurred.

Mobil has been aggressively marketing the new plastic bags in the U.S. and Union Carbide is a more recent entry. Union Carbide is a developer of the low-pressure process for making LLDPE which requires significantly less capital and energy than for making conventional LDPE. Apparently hedging their bets, a number of kraft paper bag producers have also begun making plastic bags; these include Georgia-Pacific, St. Regis Paper, Sonoco Products, Willamette Industries and Trinity Bag & Paper.

Plastics have already made somewhat greater inroads into smaller grocery bags and merchandise bags. According to one estimate plastics had captured about 35% of the 275,000-ton market for finished merchandise bags in 1981, and plastics penetration could exceed 50% in a few years.

Shipping sacks. Shipping sack paper production has remained relatively steady over the past decade and in 1981 totaled about 1.1 million tons (including bleached paper). Plastics have not made significant inroads into multiwall paper because of the high strength required

U.S. PRODUCTION OF PACKAGING AND INDUSTRIAL CONVERTING PAPER—BY END USE[1]

(000 short tons)

	Wrapping paper			Shipping sack paper			Bag and other paper			Other converting paper		
	Total	Unbl	Other[2]	Total	Unbl	Other[2]	Total	Unbl	Other[2]	Total	Unbl	Other[2]
1981p	262	142	120	1168	1083	85	2232	1990	242	675	410	265
1980	240	137	103	1154	1062	92	2330	2101	229	670	419	251
1979	306	187	119	1212	1110	102	2365	2115	250	786	499	287
1978	465	210	155	1111	1019	92	2365	2092	273	815	551	264
1977	354	218	136	1180	1073	107	2516	2212	304	794	558	236
1976	321	195	126	1228	1100	128	2428	2154	274	902	499	403
1975	280	165	115	974	879	95	2166	1938	228	752	417	335
1974	369	226	143	1409	1279	130	2134	1889	245	980	535	445
1973	425	267	158	1176	1072	104	2196	1942	254	1057	599	458
1972	498	294	204	1109	996	105	2183	1942	241	1182	694	448
1971	491	285	206	1078	976	102	2146	1911	235	1084	591	493
1970	518	298	220	1094	996	98	2117	1898	219	1088	596	492
1969	574	345	229	1123	1023	100	2016	1791	227	1146	621	525

1. Excludes glassine, greaseproof, and parchment papers, and specialty industrial papers
2. Principally bleached kraft papers

Source: Bureau of the Census

for shipping sacks and the fact that plastic can be laminated or extruded onto to it to create unique strength and barrier properties.

The new St. Regis paper machine at Pensacola is equipped with a Flakt air dryer which permits production of improved multiwall kraft paper with greater strength and stretch. The "Stress Kraft" paper permits sack converters to eliminate a ply for a basis-weight reduction of at least 18% and get the same performance as a regular sack. Developed in Europe, the technology is new to the U.S. market and is expected to cause some companies to upgrade their regular flat kraft or extensible paper machines. International Paper, for example, has come out with a new "balanced" extensible kraft paper which is said to stretch uniformly in both machine- and cross-direction.

Such technical innovations should make the future of multiwall kraft paper more secure, with projected future growth of perhaps 1%/year.

Wrapping papers. Unbleached wrapping paper has lost nearly 50% of its market in ten years to plastic films. The slippage in bleached wrapping grades is somewhat less, but here also 40% of the tonnage has been eroded away by plastic films. For the short term, further significant slippage in wrapping paper demand is not expected to occur, since films have already displaced paper in its most vulnerable market areas. It is unlikely that films can continue to displace wrapping papers, especially in such areas as butcher papers and for parcel post packaging.

Converting papers. Demand for converting paper grades, both unbleached and bleached, has declined about 40% over the past decade. Waxing and to a lesser degree gumming stock have lost tonnage, again principally because of competition from plastic film bases. Further slippage in tonnage can be anticipated for grades which are in direct competition with plastic films or used in mature industries such as automobiles, rubber and steel.

Specialty papers. Specialty industrial papers are a broad group of papers used by industry for conversion into other products. These papers may be laminated to synthetic films or paper, bonded, coated or saturated with resins. Some of the grades included under specialty papers are indicated in the tables; companies producing specialty papers are also listed.

Production of specialty papers has decreased somewhat in the last ten years. However, since it is difficult to define these grades and to separate them from other converting paper stocks, production figures are not necessarily a good indication of trends for special industrial paper grades. As a group, the demand for industrial papers has decreased, especially in areas in which plastic and synthetic products can penetrate—

U.S. PRODUCTION AND CAPACITY OF PACKAGING AND INDUSTRIAL CONVERTING PAPER BY GRADES

(000 short tons)

	Unbleached kraft		Bleached kraft*		Special industrial paper	
	Production	Capacity	Production	Capacity	Production	Capacity
1984e	—	4223	—	1076	—	892
1983e	—	4196	—	1099	—	888
1982e	—	4167	—	1098	—	875
1981	3621p	3991	977p	1091	504p	865
1980	3718	4110	876	1095	464	866
1979	3911	4098	993	1105	531	850
1978	3872	4223	1043	1041	498	883
1977	4061	4317	1002	1069	524	856
1976	3949	4218	1138	1128	574	856
1975	3399	4333	965	1194	440	841
1974	3929	4389	1205	1291	598	679
1973	3879	4138	1205	1292	610	629
1972	3927	4083	1272	1323	507	622
1971	3763	4031	1242	1383	438	549
1970	3786	4007	1231	1316	421	554
1969	3780	4006	1297	1275	443	559

* Includes glassine, greaseproof and vegetable parchment

Source: American Paper Institute and Bureau of the Census

U.S. PRODUCTION OF MAINLY BLEACHED PACKAGING AND INDUSTRIAL CONVERTING PAPERS[1]

(000 short tons)

	1981	**1980**	**1979**	**1978**	**1977**	**1976**	**1975**	**1974**	**1973**	**1972**
Total[1]	**721**	**674**	**759**	**784**	**783**	**931**	**774**	**984**	**975**	**1038**
Wrapping	120	103	119	155	136	126	115	143	158	204
MG/MF[2]	—	95	109	127	122	109	100	121	133	171
Miscellaneous	—	8	10	28	15	17	15	22	25	33
Shipping sack	85	92	102	92	107	128	95	130	104	105
Rope and combination[3]	—	—	—	—	—	29	27	39	22	23
Other	—	—	—	—	—	99	68	91	82	82
Other bag and sack	242	229	250	273	304	274	228	245	254	241
Grocer	—	155	170	217	198	153	133	144	169	168
Other	—	73	80	55	106	121	95	101	85	73
Other converting[4]	265	251	287	264	236	403	355	445	458	488
Envelope stock	—[5]	—[5]	—[5]	—[5]	—[5]	130	99	135	130	126
Gumming stock	—	32	34	23	14	12	10	11	13	13
Twisting/spinning stock	—	—	—	—	—	—	—	9	10	11
Waxing stock	—	98	113	76	69	117	97	117	138	141
Cup stock	—	—	—	—	—	—	—	34	35	48
Other[6]	—	52	59	115	100	207	94	139	132	148

1. Excluding unbleached, glassine, greaseproof and parchment papers. Principally bleached kraft paper but can include sulfite and other-fiber-based papers
2. All MG and MF wrapping papers, treated and untreated butcher papers
3. Includes unbleached and bleached sulfite and kraft and combinations of each
4. Over 18 lb
5. For 1977-80 kraft envelope included in fine sheet papers, "Book converting papers"
6. Such as asphalting, creping stock, etc.

Source: Bureau of the Census

U.S. PRODUCTION, EXPORTS AND IMPORTS OF PARCHMENT, GREASEPROOF PAPERS AND GLASSINE

(000 short tons)

	Production	**Exports**	**Imports**
1981p	256	8	5
1980	202	8	4
1979	234	8	5
1978	259	8	5
1977	219	5	3
1976	207	10	3
1975	191	11	2
1974	240	8	3
1973	230	4	3
1972	234	3	2
1971	206	3	2
1970	203	3	3
1969	216	—	—

Source: Bureau of the Census and P&P WEEK DATABOOK 1980

AVERAGE VALUE OF U.S. EXPORTS AND IMPORTS FOR PARCHMENT, GREASEPROOF PAPERS AND GLASSINE

($/short ton)

	Exports	**Imports**
1981	$1187	$1686
1980	1148	1578
1979	1008	1020
1978	833	948
1977	807	879
1976	739	849
1975	445	872
1974	655	731
1973	651	616
1972	812	581
1971	727	417
1970	671	417

Source: Commerce Dept.; P&P WEEK DATABOOK 1980 such as in resin-impregnated stocks. However, the demand for filter grades continues to expand. In turn the pricing for most grades appears fairly strong.

Glassine, vegetable parchment and greaseproof papers. These unique grades of papers have smooth, glass-like surfaces and are transparent. They find use in the protective packaging of foods, drugs, tobaccos, soaps, etc. They are also used for the windows of envelopes, in drafting and reproduction papers, and for a variety of other uses.

Glassine is produced from sulfite pulp beaten and refined to a very low freeness (drainage) This slow-draining pulp forms a dense sheet on a fourdrinier paper machine. Glassine is calendered with a supercalender to give it gloss. The standard basis for glassine is 24 x 36 in., 500 sheets. Typical wieghts are 20, 25, 30, 40, 50 lb.

Vegetable parchment is prepared by treating a sheet of paper with sulfuric acid, followed by washing and drying. The resulting sheet has, as the name implies, a "parchment" feel and appearance. These papers are manufactured plain or treated. Special treatments are waxes, lacquers, printing, embossing, laminating, metallic coatings, and others.

Glassine and greaseproof papers have been under severe competition from plastic films and have lost many of their traditional markets.

Production of these papers has been static for over ten years and in the future will probably show a gradual decline.

U.S. TOTAL PRODUCTION AND CAPACITY OF PACKAGING AND INDUSTRIAL CONVERTING PAPER

(000 short tons)

	Production	Capacity	Utilization rate %
1984e	—	6191	
1983e	—	6183	
1982e	—	6140	
1981	5433*	5947	91.4%
1980	5327*	6072	87.7
1979	5708*	6053	94.3
1978	5778*	6146	94.0
1977	5930*	6242	95.0
1976	5661	6202	91.3
1975	4804	6368	75.4
1974	5732	6360	90.1
1973	5694	6060	94.0
1972	5706	6028	94.7
1971	5443	5963	91.3
1970	5438	5940	91.6
1969	5520	5840	94.5

* For 1977 to 1981, kraft envelope tonnage excluded from each classification in table by grades, but included in totals
p = preliminary

Source: American Paper Institute and Bureau of the Census

U.S. PRODUCTION OF SPECIAL INDUSTRIAL PAPERS

(000 short tons)

	1981[1]	1980[1]	1979[1]	1978[1]	1976	1975	1974	1973	1972	
Total	**504**	**464**	**531**	**498**	**524**	**573**	**440**	**598**	**610**	**507**
Abrasive paper	—	—	—	—	7	*	*	*	*	*
Cable paper	—	—	—	—	10	*	3	6	5	9
Electrical insulation[2]	—	—	—	—	20	17	14	28	29	25
Pressboard[3]	—	—	—	—	*	*	*	*	*	*
Absorbent paper	—	—	—	—	74	77	61	84	72	55
Blotting paper	—	—	—	—	3	4	3	7	9	6
Filter paper	—	—	—	—	71	73	58	77	63	49
Matrix paper and board	—	—	—	—	*	*	2	5	7	8
Vulcanizing-fiber stock	—	—	—	—	18	18	12	25	28	26
Resin-impregnated stock	—	—	—	—	89	97	76	80	113	101
Others	—	—	—	—	276	303	243	330	317	249

1. Data for individual grades not available for 1978-81

* Data withheld to avoid disclosing figures for individual companies

2. Includes armature paper and paperboard
3. Includes imitation pressboard

Source: Bureau of the Census

U.S. PRODUCTION OF UNBLEACHED KRAFT PACKAGING AND INDUSTRIAL CONVERTING PAPERS

(000 short tons)

	1981p	1980	1979	1978	1977	1976	1975	1974	1973	1972
Total	**3621**	**3718**	**3911**	**3872**	**4061**	**3949**	**3399**	**3929**	**3879**	**3927**
Wrapping[1]	142	137	187	210	218	195	165	226	266	294
Shipping sack	1083	1062	1110	1019	1073	1100	879	1279	1072	996
Bag and sack[2]	1990	2101	2115	2092	2212	2154	1938	1889	1942	1942
Grocer	—	2074	2085	2064	2182	2108	1892	1802	1825	1854
Other	—	27	30	29	30	46	46	87	117	88
Other converting, total	410	419	499	551	558	499	417	535	599	694
Asphalting	—	176	215	173	179	167	131	134	150	165
Other creping	—	40	25	22	14	6	6	13	17	25
Envelope stock[3]	—	—	—	—	—	—	—	—	—	—
Gumming stock	—	63	80	51	66	68	61	83	90	96
Twisting/spinning stock[3]	—	—	—	—	—	—	—	—	—	—
Waxing stock[3]	—	—	—	—	—	—	—	—	—	—
Other	—	105	141	271	266	173	155	213	233	307

1. All colored or natural brown MF and MG, including treated and untreated butcher papers
2. Other than shipping sacks
3. Data not available or witheld

Source: Bureau of the Census

ESTIMATED CAPACITY OF U.S. COMPANIES PRODUCING PACKAGING AND INDUSTRIAL PAPERS

	Annual capacity (000 short tons)	Grades
1. St. Regis Paper Co.	600	Unbleached and bleached bag, sack, wrapping, and specialty papers
2. International Paper	565	same
3. Georgia-Pacific Corp.	510	same
4. James River Corp.	490	Specialty and industrial papers
5. Union Camp Corp.	425	Unbleached bag, sack, wrapping and specialty papers
6. Continental Forest Inds.	390	Unbleached bag, sack, and wrapping paper
7. Longview Fibre Co.	360	Unbleached and bleached bag, sack, wrapping and specialty papers
8. Gilman Paper Co.	200	Unbleached and bleached bag, sack, and wrapping papers
9. Crown Zellerbach	180	same
10. Hammermill Paper Co.	180	Unbleached and bleached specialty and industrial converting paper
11. Chesapeake Corp.	160	Unbleached bag, sack and wrapping
12. Champion International	155	same
13. Westvaco	140	Saturating kraft paper
14. Weyerhaeuser Co.	105	Unbleached bag, sack and converting papers
15. Wausau Paper Mills Co.	104	Glassine, greaseproof and specialty papers
16. Mosinee Paper Corp.	87	Unbleached and bleached specialty packaging and industrial converting
17. Phillip Morris Industrial	86	Specialty and industrial converting
18. Boise Cascade Corp.[2]	80	Unbleached bag, sack, wrapping and specialty
19. Willamette Industries	70	Unbleached bag, sack and wrapping
20. Sorg Paper Co.	62	Specialty and industrial
21. Shawano Paper Mills Inc.	50	same
22. Hollingsworth & Vose Co.	50	same
23. CPM Inc.	35	same
24. Equitable Bag Co.	35	Unbleached and bleached bag and sack
25. Kimberly-Clark Corp.	30	Specialty, saturating papers
26. Great Northern Nekoosa	30	Unbleached bag, sack and wrapping
27. Knowlton Brothers Inc.	30	Specialty papers, filter
28. Mead Corp.	29	Specialty and industrial converting
29. Merrimac Paper Co.	26	same
30. Monadnock Paper Mills Inc.	26	same
31. Chase Bag	22	Bag, sack, specialty papers

1. Exact capacities for packaging and industrial grades are difficult to estimate because of swing machines in the industry which can produce either linerboard or unbleached kraft packaging paper. Estimates for specialty and industrial paper may include some printing/writing paper, thin paper or tissue tonnage.

2. Includes 50% of the capacity of the joint venture Boise Southern mill at DeRidder, La., based on equity interest.

3. Includes 50% of the capacity of Schoeller Technical Papers Inc.

PRODUCERS OF VEGETABLE PARCHMENT, GLASSINE, GREASEPROOF PAPERS

		Grades	Capacity* (tpd)
1.	James River Corp.	Vegetable parchment	
	Kalamazoo, Mich.		120
2.	Canadian Glassine[1]	Glassine, greaseproof	
	Quebec City, Que.		35
3.	Deerfield Specialty[2]	Glassine, greaseproof	
	Nixon (Augusta), Ga.		55
	Monroe Bridge, Mass.		40
4.	Domtar Inc.	Glassine, greaseproof	
	St. Catharines, Ont.	vegetable parchment	230
5.	Eddy Forest Products	Vegetable parchment,	
	Espanola, Que.	greaseproof	115
6.	Nicolet Paper Co.[3]	Glassine, greaseproof	
	De Pere, Wis.		140
7.	R-W Paper Div.[4]	Glassine, greaseproof	
	Longview, Wash.		n.a.
8.	Rhinelander Paper Co.[5]	Glassine, greaseproof	
	Rhinelander, Wis.		300
9.	Riegel Products Corp.[6]	Glassine, greaseproof	
	Milford, N.J.		250
10.	Westfield River Paper[7]	Glassine, greaseproof	
	Lee, Mass.		15
	Russell, Mass.		50

* Most listings include substantial quantities of other specialty grades.

[1] Affiliated with Deerfield Specialty Papers Inc.

[2] Div. of Reed International Ltd.

[3] Div. of Philip Morris Industrial Inc.

[4] Weyerhaeuser Co.

[5] Sub. of Wausau Paper Mills Co.

[6] Sub. of James River Corp. of Virginia

[7] Sub. of Simkins Industries Inc.

Source: P&P Post's Directory, 1982

SELECTED U.S. EXPORTS OF PACKAGING AND INDUSTRIAL PAPER FOR 1981

	Quantity (000 short tons)	Average value ($/ton)
Unbleached kraft papers		
Shipping sack	41.50	$ 407
Bag/sack	61.61	473
Wrapping	7.78	637
Bleached kraft papers		
Shipping sack	21.33	449
Bag/sack	8.45	537
Wrapping	3.45	861
Converting and special industrial		
Wrapping/packaging	13.70	1272
Vegetable parchment, greaseproof, glassine	8.82	1686
Gummed or adhesive	3.99	2201
Creped, crinkled, embossed	22.13	1412
Filter, blotting, absorbent	12.24	2357

Source: Dept. of Commerce

U.S. PRICE TRENDS FOR SELECTED UNBLEACHED KRAFT PAPER GRADES

($/short ton)

	Shipping sack +50-lb	Grocery sack +70-lb
1982		
June 30	$380*	$290*
Year-end		
1981	$405	300
1980	360	330
1979	345	315
1978	305/312	290
1977	287	n.a.
1976	267	n.a.
1975	259	n.a.
1974	261	n.a.

* Reflects discounting from list prices.

Source: P&P WEEK

U.S. EXPORT AND IMPORT TRENDS FOR PACKAGING AND INDUSTRIAL CONVERTING PAPERS

(000 short tons)

	Exports[1]	Imports
1981	303	94
1980	331	86
1979	227	143
1978	173	138
1976	356	56
1974	340	142
1972	183	148
1970	188	64

[1] Includes special industrial paper and glassine, greaseproof and parchment

Source: American Paper Institute and Bureau of the Census

CANADIAN PRODUCTION AND CAPACITY FOR KRAFT PAPERS

(000 short tons)

	Production	Capacity	Utilization rate, %
1983e	—	575	—
1982e	—	622	—
1981e	570	642	88.8%
1980p	616	619	99.5
1979	677	680	99.6
1978	692	686	100.1
1977	613	684	89.6
1976	580	688	84.3
1975	475	706	67.3
1974	709	701	101.1
1973	671	663	101.2
1972	597	628	95.1
1971	540	—	—
1970	493	—	—
1969	514	—	—

Source: Canadian Pulp & Paper Assn.

ESTIMATED CAPACITY OF CANADIAN COMPANIES FOR KRAFT AND SPECIALTY PAPERS

(000 short tons)

	Annual capacity	Grades
1. Eurocan Pulp & Paper Co. Ltd.	140	Unbleached bag, sack, wrapping
2. Manitoba Forestry Resources	140	Unbleached bag, sack
3. Prince George Pulp & Paper	110	Bleached and unbleached sack, bag
4. Crown Zellerbach Canada Ltd.	88	Bag, wrapping, converting
5. Consolidated-Bathurst Inc.	84	Unbleached bag, converting, wrapping, specialty
6. Domtar Inc.	61	Bleached and unbleached bag, sack, converting, wrapping
7. Eddy Forest Products Ltd.	35	Bleached bag, sack, converting, wrapping
8. Abitibi-Price Inc.[1]	20	Specialty, converting, wrapping
9. Canadian Glassine Co. Ltd.	11	Glassine, specialty

[1] Includes Price Wilson Ltd.

TISSUE

GRADE STRUCTURE

Tissue is a lightweight grade of paper used for sanitary, packaging and cleaning purposes, and sold both to individual consumers and industrial and commercial establishments. Some major tissue producers also make feminine napkins and disposable diapers, converting both sanitary napkin stock and fluff pulp, but only primary tissue machine products will be considered in detail here. **Sanitary tissue** includes bathroom tissue, facial tissue, toweling, paper napkins, sanitary napkins and wipes. It is designed with consumer appeal in mind, and is disposable, absorbent and bulky. The two major sectors of the sanitary tissue business are consumer or resale tissue and commercial and industrial (C&I) tissue.

C&I tissue is sold to commercial business sites, industrial plants and institutions. The difference between consumer and C&I products can be minimal, although generally C&I tissue buyers are less interested in such factors as appearance and softness, and are primarily concerned with roll size and economy.

Other tissue refers to products such as wrapping tissue, waxing tissue stock, pattern tissue stock and creped wadding. These grades can be made with a glazed surface.

Basis weights vary widely, ranging from as low as 12 lb (20 g/m^2) to 39 lb (63 g/m^2), based on a ream of 24x36 in., 500 sheets.

OUTLOOK

Tissue is partly shielded from recessionary downturns and post-recession booms, since consumers rarely buy less facial or bathroom tissue or toweling simply because times are tough. The primary influence on consumer tissue demand is population change, although economic conditions do have an effect. But C&I tissue demand can be sharply influenced by changes in the direction of commercial and industrial construction. Due to weakness in sales in both sectors, the industry was hurt by the recession of 1980—which reduced total tissue industry shipments in tons by 4.5%, just as the industry was trying to absorb 1979's 4.9% capacity increase. The result was an operating rate that fell from 92.8% in 1979 to 88.3% in 1980. Mills have run at about the same rate ever since.

The next time the U.S. economy plunged, in late 1981, tissue demand and supply were more in balance, and operating rates showed none of the effects of the recession. According to Kimberly-Clark Corp. figures showing industry production on a unit basis, facial and bathroom tissue and disposable towels actually rose in 1981 by 2%, 1% and 3% respectively. American Paper Institute figures showed shipments in tons went up another 0.1% in the first half of 1982—almost the only category of paper or board production that did not fall by several percentage points.

U.S. STATISTICS FOR TISSUE

	1980	1981	1982e
Production, 000 tons*	4375	4500	4500
Capacity, 000 tons	4961	5035	5220
Utilization rates, %	88.2	89.4	86.2
Imports	4	7	5
Exporfts	60	60	55
Apparent U.S. consumption			
000 tons	4319	4447	4450
lb/capita	38.8	39.6	39.2
000 tons/$ billion real GNP	2.91	2.94	2.95

* All tons are short tons
e = PULP & PAPER estimate

U.S. PRODUCTION OF TISSUE PAPER, EXCLUDING SANITARY AND THIN PAPER

(000 short tons)

	1981[1]	1980	1979	1978	1977	1976	1975	1974
Tissue paper[2]: total	174	176	198	210	197	193	178	224
Wrapping tissue	—	72	63	74	74	61	47	44
Waxing tissue stock	—	24	31	32	28	37	39	49
Twisting tissue stock	—	13	14	12	9	8	7	10
Fruit, vegetable wraps	—[3]	—	—	—	—	—	—	—
Pattern tissue stock	—[3]	—	—	—	—	—	—	—
Creped wadding[4]	—	25	41	37	35	30	34	46
Other tissue paper	—	18	21	29	28	30	22	41

1. Preliminary 1981 data
2. Excluding sanitary and thin
3. Withheld to avoid disclosing figures for individual companies
4. Creped wadding for interior padding

Source: Bureau of the Census

U.S. PRODUCTION OF SANITARY TISSUE

(000 short tons)

	1981[1]	1980	1979	1978	1977	1976	1975	1974
Sanitary paper: total	4328	4298	4403	4036	4045	3936	3669	3799
Toilet tissue	1670	1706	1772	1629	1605	1578	1422	1415
Single-ply	—	939	978	939	877	933	828	834
Multi-ply	—	766	794	690	729	645	594	581
Facial tissue	378	370	376	383	365	359	374	395
Napkin	552	532	533	429	370	448	436	439
Single-ply	—	409	404	317	353	342	334	345
Multi-ply	—	123	129	116	117	106	102	93
Toweling[2]	1425	1439	1482	1376	1388	1335	1230	1308
Sanitary napkin wadding	303	251	240	86	73	73	53	69
Wiper stock[3]				57	48	52	62	55
Other sanitary stock				76	96	90	89	119

1. Preliminary data
2. Excludes wiper stock but includes facial tissue stock for towels
3. Regular, facial, and wadding type

Source: Bureau of the Census

The outlook for the balance of 1982 and the first half of 1983 was similar to that of the previous months. Smith Barney, Harris Upham & Co. analyst George Adler predicted a marginal decline in operating rates for 1982, forecasting "probably the best relative performance in the paper industry." Most observers expect output to remain largely unchanged through the first half of 1983, with operating rates rising from 88% or 89% in 1982 to 91% or 92% in 1983 as the relatively modest capacity expansions now planned are absorbed, and then to as much as 94% in 1984—approaching the boom-year levels of the early-to-middle 1970s.

What that should mean for tissue company pricing and profitability is a turnaround from the unimpressive performance of 1980-81, when aggressive discounting by most consumer tissue producers and reluctance to raise prices on the part of frequent price leader Procter & Gamble resulted in an 18-month period when list prices remained unchanged. Indeed, between June 1980 and June 1981, prices for toilet tissue dropped by 2% according to Bureau of Labor Statistics figures.

That period ended in September 1981 when a 7% P&G price increase was matched by other major producers. Another price increase was not expected before late 1982 or early 1983, but the price wars that had accompanied the 18-month hiatus in price increases also subsided at about the same time, so net realizations improved modestly in late 1981 and 1982.

With operating rates once again approaching the mid-90s, pricing stability should be more the rule than it was in 1980-81. Indeed, many observers think the commercial-industrial tissue field, rather than the consumer area, may face a capacity shakeout in 1983.

In general in the early 1980s the C&I mills ran at a higher operating rate and were more successful at passing along price increases than their resale counterparts. But with an increasing number of C&I tissue mills dependent on waste fiber for much or all of their furnish, this sector of the industry found its fiber costs falling drastically in the wastepaper price plunge of late 1981 and 1982. This, in effect, took the floor out from under C&I tissue pricing. And as commercial and industrial construction plunged in the recession and industrial activity dropped sharply, demand for C&I products fell—producing a spate of discounting that in mid-1982 forced industry leader Fort Howard to raise prices 5% to 6% in an effort to keep realizations level.

While C&I has been coming on hard times, consumer tissue producers such as Scott Paper have been invading the C&I market, which also added new capacity to an increasingly crowded sector of the industry. On the other hand, as Goldman Sachs analyst Bruce Kirk noted, "Fort Howard's probable addition of a fourth machine at its Muskogee, Okla., mill will now occur in 1984, not 1983 as previously estimated," which will help the industry to absorb some of the new capacity.

Wisconson Tissue was scheduled to bring on a new 65,000-tpy C&I tissue machine in the fall of 1982, partially replacing existing capacity, but on the other hand old machines—both in C&I and in consumer markets—are likely to be retired in the next few years, relieving some pressure on capacity. Already in 1982 Scott had shut down three machines at its Chester, Pa., mill, along with the last remaining machine at Oconto Falls, Wis., reducing tissue industry capacity by 100,000 tpy. A 54,000-tpy "high-technology" toweling machine in Everett, Wash., idled in early 1982 after a 1981 startup, was considered unlikely to restart soon. Nitec Paper Corp. also idled its 40,000-tpy Niagara Falls, N.Y., tissue machine as it went into Chapter XI.

MARKETS

Sanitary tissue represents about 96% of the tissue industry, and toilet tissue and toweling each make up about a third of the total sanitary and nonsanitary tissue market. These and other sanitary tissue products are sold as finished goods in cases, converted by the paper manufacturer, and very little tonnage is sold as "parent rolls" to nonpapermaking converters who turn the rolls into finished products.

The majority of consumer tissue products are sold under brand names of major companies, with the most significant players in terms of 1981 dollar sales of tissue, diaper and sanitary napkin products being (in descending order) P&G, Scott, Kimberly-Clark, Johnson & Johnson, James River, Georgia-Pacific, and Crown Zellerbach. Branded products represent about 80% of retail tissue sales, with the other 20% being "generic" and "private label"—predominantly store brands.

Private label and generic products, lower in price than branded goods, gained market share steadily during the late 1970s, but during the recession of 1981-82 they seem to have leveled off in bathroom tissues and towels, even though the low-price segment of the industry generally does best during recessions. Nonbranded disposable diapers, facial tissues and paper napkins were still gaining market share, however, according to Smith Barney analyst George Adler.

Brand-name manufacturers generally manufacture for their own use only, but a few such as G-P also sell tissue products to supermarket chains and other private-label marketers. Potlatch Corp. and others sell only under private labels. Selling to private-label marketers solves one of the major problems faced by tissue manufacturers—the exorbitant cost of sales associated with high promotional and distribution costs. Brand-name producers engage in highly sophisticated test-market activities, in which a new product is typically rolled out in a few local markets for several months of consumer reaction, and then gradually introduced through the rest of the nation—a process that can take several years and cost millions of dollars.

The cost of introducing new products is rising rapidly, partly because of pressures to discount and the heavy expense associated with advertising and distribution, and also because of the necessity to bring out an innovative and distinctive product. Product research is a major investment for firms like P&G, Scott, K-C and

Crown Zellerbach that are particularly interested in the premium end of various tissue markets.

Some producers avoid the rough-and-tumble of national-scale, premium-product marketing, and stick with regional sales. One such is Marcal Paper Mills, in the East. Mills of that kind have to win a solid following in medium- and low-cost tissue markets to survive.

The commercial and industrial segment of the industry is dominated by Fort Howard Paper Co., with about 30% of the estimated 1.4-million-tpy C&I market. Second most important producer is Scott Paper, which has about 13% of the market, by one estimate, while Crown Zellerbach, with about 9%, is also an important factor.

The dominant grade on the consumer side is bathroom tissue, but in the C&I sector, toweling is the major grade. Fort Howard has the widest range of product lines, while Scott and Crown both also offer a big variety of products. Some others concentrate in one or two areas. Wisconsin Tissue, for example, concentrates in napkins, although its new machine will also be able to produce bathroom tissue and toweling.

Other tissue includes a small but important group of specialty grades used for wrapping, cushioning, packaging and packing. Most significant—and also the only grade to show an increase in production in recent years—is wrapping tissue. Producers of these grades typically use small, old machines that could make industrial wipes also but could not compete in consumer tissue markets. As specialty tissue makers, however, they can often operate profitably within a narrow niche so long as they can pass on increased raw material and manufacturing costs.

TECHNICAL DEVELOPMENTS

The manufacture of tissue and towel products is very interesting from a technology viewpoint. Tissue and towel producers are always striving for new techniques to upgrade quality or reduce cost. This is particularly true in the high-quality grades where chemical modification, through-drying, layering, and innovative mechanical web modification techniques are employed.

In general, there are two types of sanitary tissue products being offered: high-priced, high-performance products, and lower-priced conventional sheets. High-priced, high-performance tissue is made by low-density forming techniques which yield substantial reductions in fiber costs per case of tissue.

In the conventional tissue process, water is removed on either a short fourdrinier (typically a suction breast roll unit sometimes having an inclined table) or a twin-wire former to form a coherent web of fibers. Upon drying, the fibers bond when they contact each other. Because conventional papermaking fibers are short, there is little or no physical entanglement of the fibers, and almost all of the web's strength comes from bonding.

U.S. PRODUCTION AND CAPACITY OF SANITARY PAPER AND TISSUE PAPER

(000 short tons)

	Production[1]	% change	Capacity[2]	% change
1983	—	—	5297	2.0
1982	—	—	5193	2.6
1981	4503	0.6	5062	2.2
1980	4474	−2.8	4954	1.4
1979	4601	8.9	4885	5.1
1978	4245	0.0	4644	2.1
1977	4243	2.7	4545	1.0
1976	4129	7.3	4500	1.5
1975	3846	−4.4	4432	2.5
1974	4024	1.7	4322	0.4
1973	3956	−1.6	4303	−0.3
1972	4024	3.6	4318	1.1
1971	3881	2.9	4267	1.9
1970	3768	5.3	4185	8.0
1969	3575	—	3873	—
Average 1972-81		1.6%		1.7%

1. Source: Bureau of Census, Total of sanitary paper and tissue paper
2. Source: American Paper Institute

CANADIAN PRODUCTION AND CAPACITY FOR TISSUE AND SANITARY PAPERS

(000 short tons)

		Capacity	
	Production[1]	Sanitary papers	Other tissue
1983	—	520	21
1982	—	506	21
1981	430	474	21
1980	406	414	23
1979	399	401	23
1978	368	403	24
1977	342	404	22
1976	335	385	25
1975	283	372	28
1974	361	353	27
1973	324	349	23
1972	312	344	20
1971	289	—	—
1970	240	—	—
1969	281	—	—

1. Excludes special papers

Source: Canadian Pulp & Paper Assn.

The wet-compacted web is normally dried on a yankee dryer from which it is creped off and guided onto conventional dryers or to a winder. This results in a high-density web. Thus, the softness of the conventionally formed web is reduced, not only because its stiffness is higher due to increased interfiber bonding, but also because the compressibility of the web is decreased as a result of the increased web density.

Nonetheless, machine speeds are very high. For example, 7000 fpm operating speeds are now on the horizon for Kimberly-Clark's modified Crescent former, and twin-wire formers are now operating over 6000 fpm and design speeds are over 6500 fpm. Machines equipped with through-dryers that produce low-density sheets will operate at much lower speeds.

Layered technology is another technique used to enhance the qualities of the final product. Here the headbox is designed to separate the jet into layers, with each layer having its own furnish. Layering allows sheet bulk to be increased, thus lowering sheet count per roll. The ability to concentrate the various fibers in different layers allows producers to obtain improved sheet characteristics.

In addition to the advanced wet-end technology employed, there has been extensive activity designed to improve softness without degrading strength. Paper webs are conventionally softened by working them, such as by embossing, calendering, or creping them from an adhering surface with a creping blade. Such processes disrupt and break many of the interfiber bonds. A variety of different creping and embossing methods are used in varying combinations. Often these methods are used on each ply, and then the plies are combined.

Chemical web modification and chemical additives have also been used. For example, additives to enhance the rate of water pickup have been added. A number of chemical softening techniques have been tried which involve modification of fiber-to-fiber bonding characteristics.

Machines. Because of evolving technology and different grade requirements, all machines, even at a given mill, will not be the same. Twin-wire machines have been running conventional and low-density products for several years. The older machines of more or less conventional design typically will make napkin, lower-quality toilet tissue, or facial grades. A towel machine will be different from a toilet tissue machine. Also, converting methods vary greatly from producer to producer and have a considerable effect on the final product. Existing machines often use elements of new technology such as surfactant addition to make quality gains without mechanical changes.

Soft tissue. The basic strategy behind "soft" low-density tissue lies in avoiding compaction during the papermaking process. Pneumatic methods are used to remove water, and the porous sheet enters the dryer section at about 25% consistency (vs 40% when using mechanical pressing).

This means a much greater thermal load and more drying than a yankee can be expected to handle by itself. Further, a yankee requires intimate contact with the sheet to achieve maximum drying rates. Conventionally, the sheet is pressed onto the yankee at about 300 psi, causing compaction. To avoid this, various through-drying schemes are used before and after the yankee to preserve bulk and achieve higher drying rates. A whole array of machine configurations have emerged, but, in general, substantial through-drying is necessary for low-density products.

Some technologies do away with the yankee altogether, and creping is done on smaller creping rolls. Machines are now running which use only through-drying.

Since this process avoids conventional pressing, hydrogen bonding is reduced and therefore so is tensile strength. So, soft processes generally require higher-quality furnish with long, lightly refined fiber.

For instance, one company reportedly uses roughly 50% kraft and 50% sulfite fiber. Other companies use blends of hardwood and softwood kraft pulps with or without sulfite fiber. The stuffbox freeness may be over 600, with refining used primarily to meet specific grade requirements.

Recycled fiber is used extensively in lower-quality sheets, and can consist of large amounts of groundwood. Recently commercial offerings in the mid- to high-quality range, utilizing through-drying techniques, have also incorporated substantial amounts of recycled fiber in the furnish.

Air-laid forming is becoming an increasingly viable commercial option and several products are available in the marketplace based on this technology. Initially machine speeds were slow and the resultant machine economics were unfavorable. Most air-laid tonnage is produced in Europe. Examples of products available in the U.S. include Bolt (American Can), Job Squad (Scott), and certain versions of Softique facial tissue (K-C).

Recently a large amount of work has gone into the development of bonding air-laid webs. Initially binders such as latex were applied to bond the fibers together. Recently the trend has been to use heat and pressure methods, called thermal bonding, which apply a discrete pattern using an embosser. The development of new fibers, several incorporating more than one material, have aided these advances. These bi-component fibers have a low-melting-temperature polymer surrounding a core consisting of polymer with a high melting point.

ESTIMATED CAPACITIES FOR TISSUE OF MAJOR PRODUCERS

(000 short tons)

	Annual capacity				
	U.S.	Share of U.S. capacity (%)	Canada	Share of Can. capacity (%)	Company total
1. Scott Paper Co.	1035	19.8	138	27.3	1173
2. Procter & Gamble Co.	900	17.2	—	—	900
3. Fort Howard Paper Co.	555	10.6	—	—	555
4. Georgia-Pacific Corp.	500	9.6	—	—	500
5. Kimberly-Clark Corp.	390	7.5	99	—	489
6. James River Corp.	450	8.6	—	—	450
7. Crown Zellerbach	310	5.9	—	—	310
8. Marcal Paper Mills	116	2.2	—	—	116
9. Potlatch Corp.	106	2.0	—	—	106
10. Diamond International	100	1.9	—	—	100
11. APL Corp.	90	1.7	—	—	90
12. Dominion Cellulose[1]	—	—	90	17.8	90
13. Pope & Talbot Inc.	80	1.5	—	—	80
14. Erving Paper Mills	70	1.3	—	—	70
15. Eddy Forest Products	—	—	61	12.1	61
16. Statler Tissue Corp.	53	1.0	—	—	53
17. Nitec Paper Corp.[2]	53	1.0	—	—	53

U.S. annual capacity (1982): 5.22 million tons
Canadian annual capacity (1982): 0.506 million tons

1. Sub. of CIP Inc.
2. Mill idled indefinitely; company in Chapter XI

U.S. MARKET INDICATORS FOR TISSUE PRODUCTS

	1981	1980	1979	1978	1977	1976	1975
Facial tissue							
billions, two-ply tissues	183	179	181	181	180	182	177
Disposable household towels							
billions, jumbo rolls	1.8	1.8	1.7	1.6	1.5	1.5	1.4
Bathroom tissue							
billions, rolls	6.8	6.7	6.6	6.5	6.3	5.8	5.3

Source: Kimberly-Clark Corp., 1981

TISSUE EXPANSIONS

Year	Company	Mill	Annual capacity (000 short tons)
1978	Fort Howard	Muskogee, Okla.	70 (new)
	Marcal Paper Mills	Elmwood Park, N.J.	60 (new)
	Procter & Gamble	Albany, Ga.	60 (new)
1979	Diamond International	Old Town, Maine	30 (new)
	Georgia-Pacific	Plattsburgh, N.Y.	35 (new)
	Fort Howard	Muskogee, Okla.	95 (new)
		Green Bay, Wis.	—[1] (rebuilt)
		Green Bay, Wis.[2]	—[1] (new)
1980	Potlatch	Lewiston, Idaho	50 (new)
	Kimberly-Clark	New Milford, Conn.	21 (rebuilt)
	Procter & Gamble	Albany, Ga.	—[1] (new)
1981	Scott Paper	Everett, Wash.	54[3] (new)
	CIP Inc.	Toronto, Ont.	30e (new)
	Fort Howard	Muskogee, Okla.	85 (new)
	Georgia-Pacific	Palatka, Fla.	55 (new)
1982	Wisconsin Tissue	Menasha, Wis.	35e (new)
1984	Scott Paper Ltd.	New Westminister, B.C.	40 (new)

e = estimate
1. No data available
2. Dry-forming unit for industrial wipes
3. Machine idled indefinitely

PRICE TRENDS FOR TISSUE PRODUCTS

(year-end prices)

	Toilet tissue ($/case)	Napkins, industrial ($/1000 sheets)
1982[1]	25.60	3.88
1981[2]	23.95	3.42
1980	24.69	2.36
1979	21.56	2.76
1978	20.01	2.53
1977	18.52	2.33
1976	17.37	2.19
1975	16.19	2.06
1974	14.52	1.88
1973	9.80	1.32
1972	9.31	1.18
1971	9.31	1.14
1970	9.36	1.09

1. P&P WEEK estimate for July
2. Figure for May, since second-half figures unavailable or considered unreliable

Source: P&P WEEK DATABOOK 1980;P&P WEEK estimates based on Bureau of Census data.

PAPERBOARD GRADES

Paperboard is a general term describing heavyweight grades of paper used for containers, boxes, cartons and packaging materials. Paperboard is divided into three major classes: (1) containerboard, (2) boxboard, and (3) other paperboard.

Containerboard is the largest single grade of paperboard produced and includes three major grade categories: (1) linerboard, (2) corrugating medium, and (3) chip and filler boards. Most of these grades are made from virgin kraft fiber on a fourdrinier paper machine. The bulk of containerboard produced in the U.S. is consumed by domestic corrugated container plants, but a substantial proportion of linerboard, nearly 2 million tons in 1981, is exported.

Boxboard grades include (1) folding boxboard, (2) setup boxboard, and (3) foodboard. Folding boxboard is paperboard that is die-cut to be folded into a carton. These cartons are used to package dry cereals, soap powders, pet foods, and other commonly used consumer products. Folding boxboard is made from layers (plies) of recycled fiber on a multi-ply machine, or from bleached kraft pulp on a fourdrinier paper machine. Normally it is coated to improve printability for enhanced consumer appeal.

Setup boxes are rigid or open boxes ready to receive a product. Major uses are for shoes, jewelry and candy.

Foodboard is normally produced from bleached kraft pulp on a fourdrinier paper machine. There are a number of grades, each specifically coated, waxed, or otherwise treated to handle moist or oily food products. Typical grades are milk cartons, frozen food packages, ice cream cartons, cupstock, and plates.

Other paperboard includes kraft or recycled paperboard made on either cylinder or fourdrinier paper machines. These paperboards are used for fiber cans, core or drum stock, liners for gypsum board, as well as chipboard ('cardboard') used for pad backings or for packing flat cloths or other articles.

U.S. paperboard production in 1981 totaled 31.2 million short tons—almost equal in tonnage to paper production at 31.0 million tons but lower in value. On a value-of-shipments basis, paper shipments in 1981 were near $20 billion, while paperboard shipments were about $10 billion.

Containerboard is the most important paperboard grade segment, with 1981 production for domestic use totaling 19.0 million tons, with boxboard output for the domestic market at 5.5 million tons and all other types of paperboard totaling 4.0 million tons. Paperboard exports, with linerboard and solid bleached board by far the most important categories, totaled 6.2 million tons in 1981. About 78% of U.S. paperboard is made from mainly solid woodpulp furnish, while 22% is recycled board made from wastepaper.

The Canadian paperboard industry is much smaller, with total output in 1981 of roughly 2.5 million short tons. Linerboard is by far the most important grade, with 1981 output of around 1.2 million tons, while corrugating medium production totaled about 520,000 tons and total boxboard production amounted to 750,000 tons. Canadian paperboard capacity has been fairly flat over the past decade and the future outlook for paperboard production is not bright because of the scheduled gradual lowering of tariff barriers which will make imports from the U.S. more competitive.

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U.S. PRODUCTION OF PAPERBOARD GRADES, 1981-77

(000 short tons)

	1981p	1980	1979	1978	1977
TOTAL PAPERBOARD	31,547	31,143	31,168	30,033	29,006
SOLID WOODPULP FURNISH PAPERBOARD	24,209	23,901	23,585	22,500	21,580
Unbl kraft packaging, industrial converting	15,495	15,285	14,903	14,113	13,498
Unbleached linerboard	14,437	14,249	13,857	13,215	12,660
Folding carton type paperboard	(D)	(D)	(D)	(D)	(D)
Tube, can, and drum paperboard	204	220	232	202	180
Other, including corrugating medium	(D)	(D)	(D)	(D)	(D)
Bleached packaging, industrial converting (80% bleached fiber)	4,110	4,034	4,065	4,002	3,883
Linerboard	(D)	(D)	(D)	(D)	93
Folding carton type paperboard	1,964	2,063	2,045	1,934	1,822
Milk carton board	1,035	1,023	1,066	1,048	1,040
Heavyweight cup stock	427	386	375	400	419
Plate, dish, and food-serving stock	268	273	260	277	296
Other bleached board for moist, liquid, and oily foods	(D)	(D)	(D)	(D)	53
Bleached paperboard for miscellaneous packaging	47	33	46	67	55
Other solid bleached boards	119	78	94	117	106
Semichemical paperboard	4,604	4,583	4,617	4,384	4,199
Corrugating medium	—	—	—	—	—
Other semichemical paperboard	—	—	—	—	—
RECYCLED PAPERBOARD	7,338	7,242	7,583	7,533	7,426
Recycled shipping containerboard	2,140	2,070	2,050	1,981	1,908
Linerboard	538	518	460	331	379
Corrugating medium	1,319	1,281	1,301	1,408	1,286
Container chip and filler board	281	271	290	242	243
Recycled folding carton board	2,302	2,350	2,386	2,403	2,423
Unlined chipboard	—	606	678	692	687
Kraft-lined	—	81	98	130	133
White-lined	—	220	229	251	274
Clay-coated	—	1,443	1,380	1,330	1,329
Recycled setup paperboard	510	560	604	697	717
Recycled packaging, industrial converting board	2,386	2,262	2,543	2,453	2,378
Tube, can and drum stock	—	564	628	602	680
Gypsum linerboard	—	1,036	1,210	1,185	1,099
Panelboard and wallboard stock	—	113	137	119	114
Other	—	548	568	546	485
WET MACHINE BOARD	161	138	144	136	129
Binders board	—	(D)	(D)	(D)	(D)
Shoeboard	—	25	37	37	36
Other	—	(D)	(D)	(D)	(D)
CONSTRUCTION PAPER AND BOARD	3,866	4,390	5,436	5,625	5,492
Construction paper	1,145	1,369	1,868	1,915	1,852
Sheathing paper (red rosin, asphalt, house sheathing)	—	3	14	13	21
Felts, saturating and dry					
Roofing felts	—	1,205	1,633	1,672	1,601
Floor covering (carpet felt, linoleum, wet base, etc.)	—	(D)	(D)	(D)	(D)
Automotive felts	—	(D)	(D)	(D)	(D)
Other (deadening, industrial, pipe covering, etc.)	—	(D)	(D)	(D)	(D)
Asbestos paper and asbestos-filled (e.g., electrolytic)	—	62	100	113	106
Flexible wood-fiber insulation (insulating blankets)	—	(D)	(D)	(D)	(D)
Other building paper (saturating screenings, etc.)	—	(D)	(D)	(D)	(D)
Insulating and hardpressed board	2,721	3,021	3,569	3,710	3,640
Insulating board (less than 31 lb/ft^3	846	1,051	1,263	1,416	1,403
Hardpressed board (31 lb/ft^3 or over)	1,875	1,970	2,306	2,294	2,237

p Preliminary
(D) Withheld to avoid disclosing figures for individual companies

Source: Bureau of Census

MARKET INDICATORS FOR PAPERBOARD CONSUMPTION

	Paperboard consumption (million tons)	Gross National Product (Constant 1972 million $) GNP	Durable[1]	Nondurable[1]	Industrial production index 1967=100)	Manufacturing capacity utilization %
1981	—	1,510	139	367	151	76%
1980	—	1,481	136	358	147	78
1979	27,634[2]	1,432	147	349	152	83
1978	27,852	1,399	146	343	146	84
1977	26,490	1,333	138	330	138	82
1976	25,564	1,271	126	320	131	80
1975	22,507	1,202	113	307	118	74
1974	25,390	1,218	113	304	129	84
1973	27,058	1,235	122	309	130	88
1972	26,163	1,171	111	299	119	83
1971	23,711	1,108	98	288	108	80
1970	23,325	1,075	89	283	106	81
1965	19,670	926	73	244	90	86
1960	15,150	737	53	208	66	—

1. Personal consumption expenditures
2. Based on API, 1979 consumption is 29.24 million tons

U.S. PRODUCTION OF CONTAINERBOARD FOR DOMESTIC USE

(000 short tons)

		LINERBOARD			CORRUGATING MATERIALS			Chip & filler boards
	Total	Kraft	Recycled	Total	Semichem & kraft	Recycled	Total	
1981	19,138.4	12,834.9	329.9	13,164.8	4,573.5	1,141.3	5,714.8	258.9
1980	18,070.2	11,948.6	444.5	12,393.1	4,398.5	1,047.1	5,445.6	231.5
1979	18,824.8	12,417.3	402.3	12,819.6	4,573.6	1,202.3	5,775.9	229.3
1978	17,908.2	11,877.2	256.4	12,133.7	4,305.3	1,197.7	5,503.1	271.5
1977	17,167.3	11,354.4	341.3	11,695.7	4,128.2	1,079.7	5,207.9	263.7
1976	16,700.2	11,093.2	282.7	11,375.9	3,986.5	1,075.1	5,061.5	262.9
1975	14,586.2	9,646.9	207.3	9.854.2	3,579.4	870.0	4,449.3	282.6
1974	16,767.0	10,838.4	467.1	11,305.4	4,010.3	1,169.0	5,179.2	282.3
1973	16,928.1	11,066.9	289.1	11,355.9	4,126.5	1,128.5	5,255.0	317.1
1972	16,019.0	10.577.6	278.9	10,856.5	3,874.2	972.3	4,846.5	315.9
1971	14,353.0	9,249.1	281.7	9,530.8	3,580.2	939.5	4,519.7	302.5
1970	13,964.3	9,133.4	269.7	9,403.1	3,404.7	859.3	4,264.0	297.2
1965	11,199.1	6,698.1	782.5	7,480.6	2,638.2	800.0	3,438.2	280.3
1960	8,186.6	4,731.2	743.6	5,474.8	1,788.9	672.1	2,461.0	250.8

Source: American Paper Institute and Fibre Box Assn., 1979

U.S. PRODUCTION AND CAPACITY OF PAPERBOARD

(000 short tons)

	Production[1]		Capacity[1]		Utilization
	(000 tons)	% change	(000 tons)	% change	rate(%)
1984e	—	—	36,313	0.6%	
1983e	—	—	36,087	1.9	
1982e	29,600	−5.2%	35,428	3.5	83.5%
1981	31,232	0.9	34,245	1.6	91.2
1980	30,952	−1.9	33,709	0.8	91.8
1979	31,429	3.8	33,436	2.5	94.0
1978	30,275	4.6	32,631	1.4	92.8
1977	28,953	1.8	32,173	0.2	90.0
1976	28,439	14.8	32,097	2.8	86.0
1975	24,756	−14.4	31,218	0.7	79.3
1974	28,915	− 2.2	30,995	1.5	93.2
1973	29,571	3.8	30,543	1.3	96.8
1972	28,502	9.5	30,147	5.5	94.5
1971	26,037	2.6	28,576	3.5	91.1
1970	25,383	−3.8	27,619	−0.8	91.9
1969	26,376	—	27,837	—	94.8
Average 1970-81		1.6		1.7	

e = estimated

1. Excludes capacity for hardpressed boards, wet machine boards and construction papers and boards

Source: API

U.S. PRODUCTION OF BOXBOARD AND OTHER PAPERBOARD FOR DOMESTIC USE

(000 short tons)

	BOXBOARD—DOMESTIC USE				OTHER*
	Total	Folding	Setup	Milk carton & food service	
1981					
1980	6,157,800	4,494,600	241,500	1,421,700	6,724,300
1979	6,474,600	4,724,700	306,000	1,443,900	6,129,600
1978	6,504,500	4,705,500	332,700	1,466,300	5,862,200
1977	6,332,200	4,546,700	302,500	1,483,100	5,453,500
1976	6,564,700	4,714,600	331,500	1,518,600	5,174,500
1975	5,663,800	3,896,400	304,500	1,462,900	4,505,700
1974	6,399,000	4,426,500	403,600	1,568,900	5,748,900
1973	6,764,300	4,704,500	465,300	1,594,500	5,879,200
1972	6,551,000	4,439,800	455,100	1,656,100	5,932,500
1971	6,233,600	4,139,400	447,900	1,646,300	5,450,400
1970	6,238,700	4,079,700	466,500	1,692,500	5,180,000
1965	5,811,200	3,879,600	547,300	1,384,900	4,321,200
1960	4,894,900	3,291,200	525,100	1,078,600	2,845,000

* Including exports

Source: American Paper Indstitute

CANADIAN PAPERBOARD PRODUCTION

(ooo short tons)

	CONTAINERBOARD		BOXBOARD				
	Liner board	Corrugating medium	Folding	Non-folding	Bleached board	Other	TOTAL PAPER-BOARD
1981e	1160	520	(755)[2]	—	—	—	—
1980p	1246	530	425	110	—[1]	261	2527
1979	1142	498	455	136	—[1]	291	2524
1978	1113	451	400	149	—[1]	280	2392
1977	1014	375	368	147	—[1]	239	2142
1976	1047	379	356	114	—[1]	206	2103
1975	782	339	297	103	—[1]	183	1704
1974	1203	463	259	165	120	367	2577
1973	1104	494	268	131	93	426	2515
1972	925	457	277	120	116	245	2140
1971	797	389	258	115	98	214	1871
1970	776	373	250	111	107	233	1850
1965	595	251	265	104	89	250	1553
1960	375	208	233	65	14	172	1067
1955	259	158	186	48	—	219	869
1950	214	152	158	48	4	204	708

1. Included in Boxboard, folding
2. Total boxboard; other data not available

Source: Canadian Pulp & Paper Assn.

CANADIAN EXPORTS OF PAPERBOARD[1]

(000 short tons)

	Linerboard	Corrugating medium	Boxboard
1981	295	170	37
1980	355	198	40
1979	288	157	39
1978	283	177	54
1977	393	105	20
1976	318	90	7
1975	198	53	11
1974	414	96	22
1973	311	140	23
1972	222	147	17
1971	173	133	22
1970	201	102	13
1965	123	46	16

1. Canadian imports of paperboard are minor. For example, in 1976, Canada imported less than 100,000 tons of containerboard.

Source: Canadian Pulp & Paper Assn.

CANADIAN PAPERBOARD CAPACITY

(000 short tons)

	LINERBOARD		CORRUGATING MEDIUM		SOLID BLEACHED BOARD	BOXBOARD Folding, others[1]
	Kraft	Recycled	Semichem	Recycled		
1983e	1102	322	562	122	114	804
1982e	1100	314	557	120	110	792
1981e	1073	307	551	117	105	782
1980	1056	289	545	114	105	785
1979	1074	267	520	115	137	832
1978	1069	272	517	116	135	812
1977	1300	278	510	116	131	757
1976	1374	221	455	93	116	709
1975	1311	153	443	87	108	712
1974	1262	135	437	74	105	648
1973	1141	116	422	61	100	618
1972	817	103	406	62	97	598
1971	811	124	422	68	119	585

1. Includes mill wrappers but excludes solid bleached board

Source: Canadian Pulp & Paper Assn., June 1981

LINERBOARD

Linerboard is a commodity grade of paperboard used in the production of corrugated containerboard. It is used as the top and bottom facing (liner) placed over corrugating medium to form the rigid structure of the combined board. Linerboard provides the strength component of a container, while corrugating medium provides rigidity or stiffness.

Unbleached linerboard is made in a wide range of basis weights. The standard kraft liner is 42 lb/1000 ft^2, but other important grades are produced in weights of 26, 33, 38, 69, and 90 lb.

Kraft linerboard is made predominantly from softwoods (southern pine, Douglas fir, and eastern pines and spruces) but it may also contain some hardwood kraft pulp. Normally, linerboard is produced in two plies—top and bottom liners. The bottom liner, comprising up to 85% of the fiber furnish, is made from high-yield kraft; whereas the top liner, applied with a secondary headbox, is made from a higher quality pulp (either of lower yield or else highly refined) with better sheet properties to permit an adequate level of printing quality at container plants. Also, to improve printability, starch is applied to the liner at a size press. Linerboard may be treated internally with sizes and wet-strength agents to develop desired sheet properties. About 4% of all linerboard produced in the U.S. is wet-strength treated. Each weight of linerboard is controlled, normally by refining, to give a minimum burst strength (mullen).

During the past decade, kraft linerboard mills have increased their use of wastepaper furnish, although there are still a few mills that use 100% virgin pulp. The principal wastepaper grades used are recycled corrugated containers ("old corrugated") and new double-lined kraft cuttings. Usage varies, with the maximum wastepaper use by any one mill probably not over 25% of the total furnish requirement. Average wastepaper usage is currently around 10% of furnish, but by 1990 may increase to around 20%. A few mills produce linerboard from 100% wastepaper, called "test" linerboard, either on fourdrinier or multi-ply cylinder machines. Test liner is made in the 85 to 100-lb burst range. (For a discusssion of test liner, see section on Recycled Paperboard)

INDUSTRY STRUCTURE

Kraft linerboard is produced at large integrated kraft pulp and paper mills. These mills are located primarily in the U.S. South (about 83% of total U.S. capacity) and the West, with a small amount of of capacity also located in eastern Canada and British Columbia.

Over 93% of linerboard sold is unbleached. Linerboard that is bleached is sold as either solid bleached board or as white top board, made by adding a thin layer of bleached fiber to the top of an unbleached sheet. This is also referred to as "mottled white"

U.S. STATISTICS FOR UNBLEACHED KRAFT LINERBOARD

	1980	**1981**	**1982e**
Production, 000 tons	14,232	14,558	13,500
Capacity, 000 tons	14,586	15,340	16,086
Utilization rates, %	97.6	94.9	83.9
Imports, 000 tons*	30	48	30
Exports, 000 tons*	2,293	1,822	1,920
Apparent U.S. consumption			
000 tons	11,969	12,784	11,610
lb/capita	105.1	114.9	100.2
000 tons/$ billion real GNP	8.08	8.46	7.81

* Commerce Dept. data
e = estimated

linerboard and accounts for about 6% of total linerboard production. Solid bleached linerboard production in U.S. in recent years has been around 100,000 tons, less than 1% of total linerboard output.

U.S. PRODUCTION AND CAPACITY OF UNBLEACHED LINERBOARD

(000 short tons)

	Production[1]		Capacity[2]	
	Tonnage	% change	Tonnage	% change
1984e	—	—	16,396	0.5%
1983e	—	—	16,307	1.4
1982e	—	—	16,086	4.9
1981	14,558	2.3%	15.340	5.2
1980	14,232	2.0	14,586	2.7
1979	13,951	5.5	14,199	2.4
1978	13,228	5.2	13,864	1.9
1977	12,573	2.6	13,586	1.4
1976	12,251	12.4	13,448	2.4
1975	10,635	−10.6	13,138	1.8
1974	12,333	− 3.7	12,901	0.3
1973	12,536	4.4	12,862	2.3
1972	12,335	9.1	12,568	6.5
1971	11,308	3.0	11,797	0.6
1970	10,982	0.3	11,718	—

1. Source: API and Bureau of the Census
2. Source: API
e = estimated

U.S. EXPORT AND IMPORT OF LINERBOARD GRADES

(000 short tons)

	Exports		
	Unbleached	Bleached	Imports[1]
1981	1822	152	48
1980	2293	234	43
1979	1465	180	26
1978	1345	194	32
1977	1297	130	14
1976	1288	131	4
1975	1075	149	—[2]
1974	1609	133	10
1973	1576	70	6
1972	1727	150	1
1971	1966	—	10
1970	1761	—	—[2]

1. Includes test of containerboards with burst test of over 60 lb
2. Imports less than 500 tons

Source: U.S. Dept. of Commerce

In most cases, linerboard is produced on wide (220-in. or more) conventional fourdrinier paper machines at speeds of 1000 to 2000 fpm. Linerboard is sold in rolls, the size of the roll determined by corrugator width.

Kraft linerboard mills are often integrated with other pulp and paper operations. For example, about 20 U.S. mills also produce semichemical corrugating medium and a large number of mills produce sack and bag kraft paper grades. Some machines have capacity to "swing" from kraft sack and bag grades into lighter-weight linerboard. Such swing capacity in the U.S. industry has been estimated at around 1 million tons.

The efficiency of kraft mills varies considerably and consequently so do the economics of manufacturing linerboard. For example, large, modern linerboard mills (such as those of International Paper at Mansfield, La., or Union Camp at Montgomery, Ala.) can produce more than 5.0 tons of linerboard per man-day, while some older, less efficient mills might produce only 1.5 tons.

Wood costs also vary widely. Mills using wastewood residuals from sawmills normally have a lower wood cost base than mills relying on pulpwood logs. But residual-based mills can also face chip shortages and high fiber costs when sawmill operating rates are low due to depressed housing starts. This has been the recent situation on the West Coast where mills are heavily based on residuals.

As a result, production costs have been higher in the West, around $320 to 330/ton in early 1982 (based on market prices for internally transferred chips), compared to around $270 in the South. Future growth in liner capacity will probably be concentrated in the South, while the western mills may become more directed toward serving export markets.

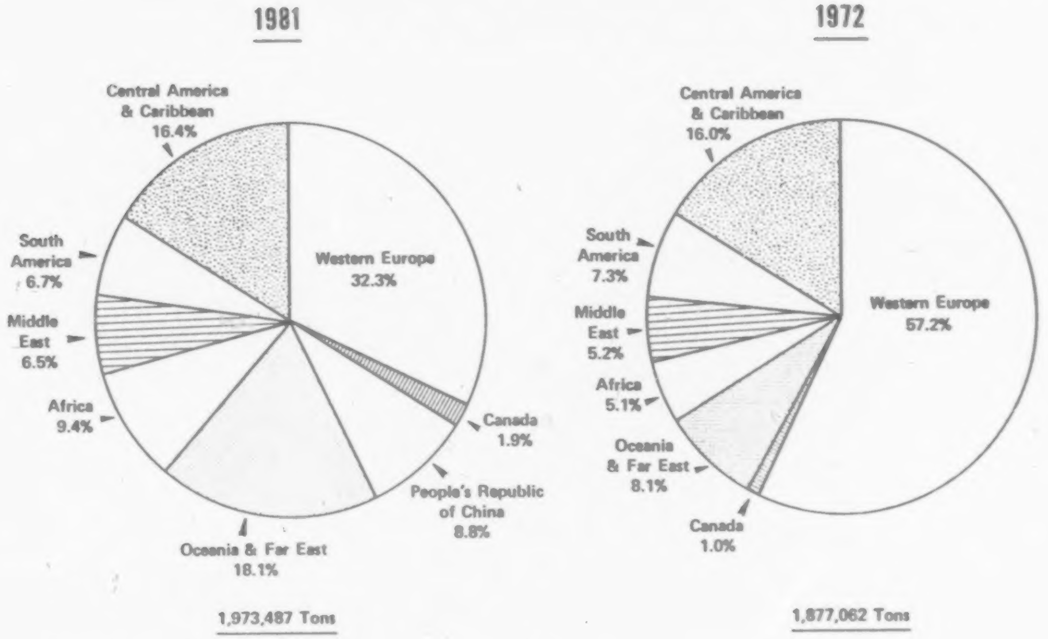
PRODUCTION/CAPACITY TRENDS

The main factors affecting linerboard production are domestic corrugated container output, export demand and inventory fluctuations.

Corrugated box demand tends to closely track general economic activity, especially the Federal Reserve Board index of industrial production. The kraft linerboard market is fairly fragmented, with the ten largest producers accounting for about 60% of production. More than 80% of the linerboard output is captively converted in integrated container plants, with the remainder sold on the open market to independent box plants (for description of smaller Canadian industry see chapter on Corrugating Medium).

Export linerboard shipments have been growing in recent years as a percentage of total linerboard production, hitting a record 2.527 million tons (including bleached) in 1980, up 54% from 1979 and 29%

PERCENTAGE DISTRIBUTION OF U.S. LINERBOARD EXPORTS BY AREA OF DESTINATION



Source: American Paper Institute

U.S. EXPORTS OF KRAFT LINERBOARD BY AREA OF DESTINATION

(000 short tons)

	1981	1980	1978	1972
Canada	39	26	39	19
Western Europe	637	919	623	1073
Central America/Mexico	275	337	270	243
Caribbean/Other Islands	48	46	72	58
South America	131	130	146	137
Middle East	128	99	107	97
Africa	185	241	80	96
Oceania/Far East	357	411	199	152
People's Rep. of China	174	319	3	—
TOTAL	1973	2527	1540	1877*

* Includes 303 tons not distributed by area of destination.

Source: API from Dept. of Commerce

from their previous peak set in 1971. Western Europe has traditionally been the largest market for U.S. exports but the Far East has been accounting for a growing share of U.S. overseas shipments.

1981 performance. In 1981, unbleached kraft linerboard production increased 2.3% to 14.558 million tons, reflecting a 1.6% rise in box shipments and a huge 556,000-ton surge in inventories. At year-end total containerboard inventories (including corrugating medium) held by box plants and mills stood at a record 2.729 million tons, equivalent to 9.4 weeks of supply, according to Fibre Box Assn. data.

Exports of linerboard dropped 21.9% to 1.973 million tons in 1981 from their record level a year earlier, reflecting the growing impact of the recession on the economies of Western Europe and Japan, higher value of the dollar which reduced competitiveness of U.S. exports, and lower shipments to People's Rep. of China which made its first heavy purchases in 1980.

Linerboard capacity in 1981 rose by 5.2%, reflecting full-year performance of several new machines installed the prior year, the startup of two new machines late 1981 (IP at Mansfield, La., and Stone Container at Florence, S.C.), as well as a shift of some kraft paper production into linerboard. Operating rates declined from 97.6% in 1980 to a still healthy 95% for 1981 but began declining sharply in fourth-quarter 1981 as mills took increasing downtime to better balance production with weakening demand.

1982 forecast. With corrugated container production projected to decline by 3.5% to 244.1 billion ft^2 in 1982, demand for linerboard for domestic container production should amount to 11.8 million tons (see tables for conversion ratios). Export shipments are projected to rise about 5% to 1.9 million tons (unbleached only) with the beginning of a modest recovery in Japan and Europe. Assuming inventory liquidation of around 200,000 tons, total production would be about 13.5 million tons, 7% below the previous year.

Linerboard capacity is projected to grow by 4.9% in 1982, reflecting full-year production of the two machines that went on line in late 1981, midyear startup of Weyerhaeuser's new 200,000-tpy lightweight liner machine at Valliant, Okla., and some further shifting of kraft paper production into linerboard. Actual growth, however, will be somewhat less, due to IP's decision in early 1982 to permanently shut down 185,000-tpy of liner production as part of a program to convert its Georgetown, S.C., mill to bleached grades. Operating rates should average around 83%, considerably below the 91% to 93% necessary for pricing strength.

U.S. PRICES FOR EXPORT LINERBOARD +36-lb (+175 g) c.i.f. northern Europe

	$/short ton	$/metric ton
1982		
2nd quarter		
1st quarter	327/336*	360/370*
1981		
4th quarter	336/399*	370/440
3rd quarter	399	440
2nd quarter	399	440
1st quarter	377	415
1980		
4th quarter	377	415
3rd quarter	377	415
2nd quarter	377	415
1st quarter	345	380
Year-end		
1979	323	355
1978	260	285
1977	222	245
1976	222*	245
1975	276*	245
1974	305	335
1973	220	240
1972	155	170
1971	125	137
1970	n.a.	n.a.

* Estimated transaction prices taking place below list.

Source: P&P Week, P&PW Databook 1980

PRICING

The price of 42-lb kraft linerboard east of the Rockies reached the $300/ton level at the beginning of 1981 and remained at that level through most of the year despite several attempts to raise prices again by $25 to $30/ton. Increasingly weak market conditions and jockeying among producers for market share resulted in a round of $30/ton "rebating" in December/January and again in late spring and the seasonally weak summer months in 1982. West Coast liner prices had been at $330/ton due to higher chip costs in the region, but were lowered by some producers in early 1982.

Export liner prices are normally at a premium to domestic in a tight market and at a discount in weak markets as has been the case in the recent 1982 recession. U.S. producers last raised prices in April 1981 by $25 to the $445/metric ton delivered to northern Europe, but prices began to deteriorate in the fourth quarter as European economies weakened and the U.S. dollar grew in strength. By early summer 1982 effective prices in Europe ranged from a high of $360 in England to a low of around $320 in Fed. Rep. of Germany. Price erosion began earlier and was even more severe in the Far East, with irregular sellers trying to unload board at deep spot discounts.

1981 LINERBOARD EXPORTS FROM MAJOR PRODUCING COUNTRIES

(000 metric tons)

Importer	**Exporter**				
EUROPE	**USA**	**Canada**	**Sweden**	**Finland**	**Norway**
Austria	—	—	11	2	—
Belgium	8	63	29	8	—
Denmark	1	—	47	8	—
France	17	14	176	21	—
Germany, Fed. Rep.	153	2	157	37	1
Greece	13	—	8	0	—
Ireland	4	—	28	1	—
Italy	72	—	21	4	—
Netherlands	46	1	72	20	—
Norway	3	—	24	5	—
Spain	14	—	—	4	—
Switzerland	—	6	16	4	—
United Kingdom	243	55	177	47	7
USSR	—	—	—	65	—
Other	1	—	13	16	—
Total Europe	**575**	**141**	**779**	**237**	**8**
NORTH AMERICA					
Canada	40	—	—	—	—
United States	—	42	—	—	—
Total North America	**40**	**42**	**—**	**—**	**—**
ASIA & AUSTRALASIA					
China	187	—	—	—	—
Hong Kong	56	—	—	—	—
Iran	—	—	12	2	—
Israel	72	—	2	3	—
Japan	115	40	—	—	—
Korea, Rep.	13	2	—	—	—
Malaysia	16	2	—	—	—
Philippines	48	—	—	—	—
Singapore	33	7	—	—	—
Taiwan	10	—	—	—	—
Other	81	1	22	6	—
Total Asia/Australasia	**631**	**53**	**36**	**11**	**—**
LATIN AMERICA					
Colombia	64	—	—	—	—
Costa Rica	86	—	—	—	—
Ecuador	44	—	—	—	—
Guatemala	35	—	—	—	—
Mexico	20	—	—	—	—
Panama	44	—	—	—	—
Other	127	22	—	—	—
Total Latin America	**420**	**22**	**—**	**1**	**—**
AFRICA					
Egypt	31	—	—	—	—
Ivory Coast	21	—	—	—	—
Morocco	3	—	8	2	—
Nigeria	3	—	2	2	—
South Africa	21	—	—	—	—
Other	118	—	10	4	—
Total Africa	**197**	**—**	**20**	**8**	**1**
WORLD TOTAL	**1,784**	**258**	**835**	**257**	**9**

Source: PULP & PAPER INTERNATIONAL, annual review 1982

OUTLOOK

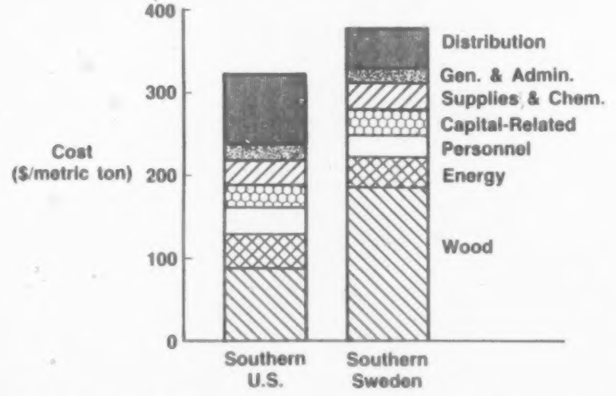
The outlook for linerboard appears fairly bright over the next several years, based on renewed growth in domestic corrugated container shipments, greater penetration of export markets, and limited new capacity additions. This should bring linerboard demand into better balance with supply and enable prices to increase at a faster pace than inflation, helping the industry improve its recent marginal profitability. Market conditions will not be as tight some analysts earlier forecast, however, due to the depth of the recent recession and shift of some unbleached kraft paper capacity into linerboard production.

Domestic demand. With a sustained economic recovery, domestic corrugated container shipments should track industrial production at a 3% to 4% annual rate over the next several years. This would result in a somewhat lower rate of growth in domestic linerboard demand due to further inventory reduction.

Factors which could impede linerboard demand include competitive inroads into the corrugated container market by plastic shrink and stretch films and proposed new box specifications permitting use of lighter weight facings. Use of plastic film to unitize loads of canned, bagged and boxed products on a corrugated tray will probably achieve some growth at the expense of all-corrugated shipping containers. But agreement by corrugated producers and rail and truck lines on modifying carriers rules (Rule 41 and Item 222) governing box specifications will probably prove difficult.

COST COMPARISON BETWEEN PRODUCING KRAFT LINERBOARD IN U.S. SOUTH AND SWEDEN, DELIVERED TO NORTHERN EUROPE

(4th quarter 1981)*



* U.S. $1 = Skr 5.47

Source: Arthur D. Little Inc., *International Competition in Pulp, Paper and Paperboard: The Future North American Position and Its Implications* (Cambridge, 1982), distributed by Miller Freeman Publications Inc.

U.S. PRICES FOR UNBLEACHED KRAFT LINERBOARD

(42-lb, domestic market)

	$ per short ton*	$ per 1000 ft²
1982		
2nd quarter	270/300	5.67/6.30
1st quarter	270/300	5.67/6.30
1981		
4th quarter	270/300	5.67/6.30
3rd quarter	300	6.30
2nd quarter	300	6.30
1st quarter	300	6.30
1980		
4th quarter	270	5.67
3rd quarter	270	5.67
2nd quarter	270	5.67
1st quarter	270	5.67
Year-end		
1979	250	5.25
1978	220	4.62
1977	195	4.11
1976	210	4.40
1975	202	4.24
1974	207	4.34
1973	140	2.95
1972	128	2.69
1971	123**	2.59**
1970	118**	2.48**

* List prices on West Coast have generally been $30/ton higher since March 1980.
** Classified as 85-100 test

Source: P&P Week, P&PW Databook 1980

Export demand. Export shipments should show faster long-run growth than domestic demand, helped by the U.S. industry's low manufacturing costs and relatively abundant softwood supplies.

U.S. linerboard exports to Western Europe, the largest importing region, began to reverse a declining trend in the late 1970s. Although shipments were down 30.6% in 1981, future demand should be helped by shutdown of a substantial amount of testliner capacity in the United Kingdom and fiber constraints on Scandinavian producers, causing them to emphasize production of higher-value paper grades. U.S. export shipments to Western Europe in 1981 totaled 637,000 tons, while those by Scandinavian suppliers amounted to 1.08 million tons.

The export outlook is even brighter in the Far East where China has emerged as a major linerboard purchaser and Japan is phasing out some uneconomic capacity and limiting further expansion. To package its growing exports of light industrial products, China dramatically increased its imports of U.S. liner from virtually nothing to 319,000 tons in 1980 and 174,000 tons in 1981. Although shipments are expected to decline again in 1982, China's longer-run needs for foreign linerboard imports have been estimated at between 200,000 to 300,000 tons annually.

U.S. linerboard exports to Japan reached a record 162,000 tons in 1980, more than double their level the previous year, before declining to 126,000 tons in 1981. The Japanese industry is phasing out about 15% of its less-efficient capacity, limiting future expansion, and plans to rely on imports because of a large disadvantage in fiber and energy costs. Ministry of International Trade & Industry (MITI) projects Japan's total linerboard imports will rise from 176,000 tons in 1979 to 560,000 tons in 1990.

Other Asian markets such as Hong Kong, Singapore and Malaysia have also shown increasing demand for U.S. linerboard in recent years. As a percentage of total U.S. exports, shipments to Western Europe have declined from 57.2% in 1972 to a low of 32.3% in 1981, while those to the Far East have risen from 8.1% to 26.9% and shipments to Latin America have remained relatively stable at around 22%.

Limited capacity growth. U.S. linerboard capacity is forecast to grow by only 1.4% in 1983 and 0.5% in 1984—and the latter year will probably show negative growth once the shutdown of the second 280,000-tpy machine at Georgetown, S.C. (planned by IP for late 1983) is reflected in statistics. One or two other companies are also reportedly studying conversion of older, less efficient unbleached kraft mills to bleached pulp or paper production.

No new machines have been announced by major established producers with definite startup dates beyond 1982, although two newly organized firms have publicized plans to build new "greenfield" mills in the Southeast. Even if either of these projects moves ahead, however, completion by the announced startup date of late 1984 is unlikely, since construction of a new mill normally takes close to three years.

Georgia-Kraft and Champion International each have new linerboard mills under study for the South, while Owens-Illinois and Georgia-Pacific have each discussed adding new machines at existing mills.

One factor which could have an impact on linerboard operating rates is a permanent shift in some swing capacity from unbleached **kraft paper** production which has been under increasing competitive pressure from plastics. Plastics have already made major inroads into

ESTIMATED UNBLEACHED KRAFT LINERBOARD CAPACITIES OF U.S. COMPANIES

Capacity[1]	Annual share (000 tons)	Capacity (%)
1. International Paper	1850	11.5
2. Weyerhaeuser	1390	8.6
3. Union Camp	1355	8.4
4. St. Regis Paper	930	5.8
5. Champion International	910	5.7
6. Container Corp. of America	745	4.6
7. Inland Container (Time)	735	4.6
8. Continental Forest Industries	705	4.4
9. Owens-Illinois	695	4.3
10. Great Northern Nekoosa	650	4.0
11. Westvaco	618	3.8
12. Stone Container	582	3.6
13. Packaging Corp. of America	565	3.5
14. Mead[2]	545	3.4
15. Willamette	520	3.2
16. MacMillan Bloedel[3]	445	2.8
17. Southwest Forest	430	2.7
18. St. Joe Paper	425	2.6
19. Crown Zellerbach[3]	405	2.5
20. Arkansas Kraft (Green Bay Pkg.)	380	2.4
21. Longview Fibre	307	1.9
22. Alton Packaging (Smurfit Indus.)	300	1.9
23. Georgia-Pacific	275	1.7
24. Chesapeake Corp. of Virginia	230	1.4
25. Louisana-Pacific	210	1.3
26. Interstate	205	1.3
27. Boise Cascade[4]	185	1.1

Total U.S. capacity (1982): 16.086 million tons
Capacity share of top 5 companies: 40.0%
Capacity share of top 10 companies: 61.9%

[1] Swing tonnage makes exact capacity estimates difficult.

[2] Includes 50% share in Georgia Kraft Corp.'s mills at Rome and Macon, Ga., with all liner output from the Phenix City, Ala., coated kraft board mill assigned to Inland Container.

[3] Excludes Canadian capacity.

[4] Includes 50% interest in Boise Southern Corp.

merchandise bags and now threaten to capture a share of the 1.3-million-ton grocery sack market. A number of forecasters have estimated that plastics could capture 20% to 25% of the grocery sack market by the mid-1980s. The threat of significant capacity shifting into linerboard, however, has been reduced by a number of shutdowns in the kraft paper sector that have kept operating rates at a fairly high level (see chapter on Kraft Packaging Paper).

Another technological development which could have a significant impact on future linerboard capacity growth is the **extended nip press** developed jointly by Beloit Corp. and Weyerhaeuser Co. The new press can result in as much as a 25% increase in incremental capacity while reducing dryer section energy use per ton by as much as 20%. Weyerhaeuser is adding extended nip presses to three of its linerboard machines and any rush by other producers to make similar installations could have a substantial impact on overall industry linerboard capacity.

FACTORS FOR CONVERTING PRICES FROM \$/TON TO \$/1000 FT^2, AND FROM \$/1000 FT^2 TO \$/TON

Basis weight (lb/1000 ft^2)	FACTOR 1 \$/1000 ft^2 to \$/ton	FACTOR 2 \$/ton to \$/1000 ft^2
26*	76.92	0.01300
31*	64.52	0.01550
33*	60.61	0.01650
36*	55.56	0.01800
38	52.63	0.01900
42	47.62	0.02100
47	42.55	0.02350
69	28.98	0.03451
90	22.22	0.04500

To convert the price per 1000 ft^2 to equivalent price on a per ton basis, multiply the price by FACTOR 1. For example, if the price of 33-lb linerboard is \$4.79/1000 ft^2, multiply \$4,79 by 60.61. The price per ton is \$290.

To convert the price per ton to equivalent price per 1000 ft^2, multiply price by FACTOR 2.

* Corrugating medium weights. Linerboard is normally produced at 26, 33, 38, 42, 47, 69 and 90 lb/1000 ft^2.

RATIO OF U.S. CONSUMPTION OF PAPERBOARD TO CORRUGATED CONTAINER PRODUCTION

CORRUGATING MEDIUM TONNAGE FOR CONTAINERS

	Consumption by box plants (000 short tons)		Ratio
	Linerboard	Corrugating medium	(liner/medium)
1981	12,262	5,530	2.22
1980	12,019	5,427	2.21
1979	12,456	5,654	2.20
1978	12,168	5,495	2.21
1977	11,318	5,103	2.22
1976	10,782	4,844	2.22
1975	9.609	4,320	2.22
1974	10,621	4,746	2.24
1973	11,315	5.060	2.24
1972	10,429	4,698	2.22
1971	9,465	4,273	2.22
1970	9,079	4,107	2.21

LINERBOARD TONNAGE FOR CONTAINERS

	Corrugator production (billion ft^2)	Linerboard consumed by box plants (000 tons)	Ratio (1000 ft^2/ton)
1981	253.0	12,262	20.633
1980	251.9	12,019	20.958
1979	261.1	12,456	20.962
1978	256.4	12,168	21.072
1977	238.8	11,318	21.099
1976	227.8	10,782	21.128
1975	203.2	9,609	21.147
1974	224.1	10,621	21.100
1973	238.5	11,315	21.078
1972	220.1	10,429	21.105
1971	200.3	9,465	21.162
1970	192.7	9,079	21.225
			Average: 21.056

Source: Based on data from Fibre Box Assn.

MONTHLY CONTAINERBOARD INVENTORY AT U.S. BOX PLANTS AND MILLS

(000 short tons/weeks of supply*)

	1982p		1981		1980		1979		1978		1977		1976		1975		1974	
Month	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks	Tons	Weeks
Jan. 1	2729	9.4	1984	6.2	1979	6.2	1961	5.8	2437	7.2	2507	8.0	2185	7.2	2323	8.9	1595	4.7
Feb. 1	2545	8.0	1960	5.5	1991	5.3	1825	5.1	2297	7.0	2376	7.8	2136	7.0	2156	8.5	1541	4.6
Mar. 1	2468	7.3	2029	5.6	1905	5.4	1807	5.1	2242	6.6	2393	7.7	2138	7.1	2233	9.0	1527	4.6
Apr. 1	2570	7.4	2104	5.7	1890	5.4	1789	5.0	2208	6.1	2412	7.5	2172	7.0	2264	9.0	1558	4.7
May 1	—	—	2232	5.9	2021	5.7	1846	4.8	2179	6.4	2463	7.4	2316	7.4	2306	9.1	1623	5.0
June 1	—	—	2298	6.7	2119	6.5	1856	5.2	2155	6.0	2513	7.5	2393	7.5	2296	8.6	1732	5.4
July 1	—	—	2368	6.7	2248	7.0	1863	5.3	2169	6.1	2577	8.0	2506	8.2	2244	8.1	1810	5.8
Aug. 1	—	—	2371	6.9	2291	7.3	1939	5.5	2206	6.6	2581	8.3	2539	8.4	2125	7.8	1833	5.9
Sept. 1	—	—	2376	6.9	2225	7.1	1945	5.6	2119	6.0	2613	8.0	2604	8.5	2079	7.0	1907	6.3
Oct. 1	—	—	2451	6.6	2101	5.8	1938	5.3	2004	5.5	2457	7.2	2442	7.7	1969	6.1	1925	6.4
Nov. 1	—	—	2437	7.1	1880	5.6	1877	4.8	1923	5.1	2439	7.1	2456	7.6	1964	6.4	1965	6.7
Dec. 1	—	—	2602	7.9	1836	5.5	1953	5.5	1939	5.6	2442	7.2	2516	7.9	2079	6.9	2078	7.0

* Obtained by dividing inventories by average weekly usage in corrugated box plants during prior month, excluding holidays.
p = Preliminary

Source: Fibre Box Assn. annual reports.

CURRENT LINERBOARD GRADE STRUCTURE

Basis weight (lb/1000 ft^2)	Maximum burst test[1] (psi)	Grade distribution[2] (%)
26	65	5
33	80	11
38	90	7
42	100	50
47	—	—
69	135	21
90	160	4
other	—	2

1. Typical mill run
2. Based on data from 1979

Source: P&P, April 1979; Fibre Box Assn., 1979

CORRUGATING MEDIUM

Corrugating medium is used to form the central or middle fluting material in corrugated containerboard. It is first fluted or corrugated in a corrugator, then faced on both sides with linerboard to form the rigid combined board.

Corrugating medium includes paperboard made from both semichemical pulp and recycled fiber. In 1981, 78% of all U.S. corrugating medium was made from a semichemical pulp furnish, while 22%, called "bogus" medium, was produced from recycled fiber. Basis weights of corrugating medium are 22, 26, 31, 33 and 36 lb/1000 ft^2.

Semichemical corrugating medium is made primarily from hardwoods, but some western mills use softwood species. Softwood sawdust is also used Nearly all types of hardwood species are used, but some semichemical mills find it difficult to pulp certain species, such as white oak. Semichemical medium is normally manufactured on conventional fourdrinier paper machines, but a small percentage is produced on cylinder board machines.

Semichemical medium contains some long fiber to improve paper machine runability and also to lessen the tendency of the medium to crack and break upon corrugating. The principal sources of long fiber are waste corrugated containers and new double-lined kraft cuttings. The amount of secondary fiber used varies from none to 50%, but average wastepaper content is close to 20%. In some cases, screenings from kraft mills or kraft softwood pulp is used as the source of long fiber.

Mills producing corrugating medium from 100% wastepaper (bogus medium) use primarily old corrugated containers as a source of fiber. Because waste corrugated containers contain foreign materials (tape, hot melts, latexes, asphalt, waxes, etc.) mills use cleaning equipment on the stock to remove contaminants. To improve the strength of bogus medium, a number of additives are used—typically, modified starches and gums. At a 5 to 10 lb/ton level these additives can improve concora (strength) by 10% to 20%.

The principal test used to judge the strength of corrugating medium is the concora test. Concora is normally controlled by refining and by choice of fiber types. Typical concora values for standard basis weights

U.S. STATISTICS FOR CORRUGATING MEDIUM

	1980	**1981**	**1982e**
Production, 000 tons			
Semichemical[1]	4723	4717	4460
Recycled[2]	1281	1319	1150
Total	6004	6036	5610
Capacity, 000 tons			
Semichemical	4946	4952	5180
Recycled	1330	1332	1385
Utilization rates, %			
Semichemical	95.5	95.3	86.1
Recycled	96.3	99.0	83.0
Imports, 000 tons[2]	31	52	30
Exports, 000 tons[1]	322	140	160
Apparent U.S. consumption			
000 tons	5713	5948	5480
lb/capita	50.2	51.8	47.3
000 tons/$ billion real GNP (1972)	3.85	3.94	3.68

1. API data.
2. Bureau of Census data.
e = Estimated.

ESTIMATED CORRUGATING MEDIUM CAPACITIES FOR U.S. PRODUCERS

Annual capacity (000 tons)

	Semi-chemical medium	Recycled medium	Total	Capacity share (%)
1. Owens-Illinois	580	—	580	8.8%
2. Weyerhaeuser	575	—	575	8.7
3. International Paper	485	—	485	7.4
4. Container Corp of America	235	155	390	5.9
5. Inland Container	175	210	385	5.9
6. Champion Intl.	200	120	320	4.9
7. Mead Indus.	300	—	300	4.6
8. Willamette Indus.	220	65	285	4.3
9. Packaging Corp. of America	254	—	254	3.9
10. Stone Container	247	—	247	3.8
11. Virginia Fibre	208	—	208	3.2
12. Alton Packaging (Smurfit Industries)	—	200	200	3.0
13. St. Regis Paper	63[1]	132	195	3.0
14. Great Southern	176	—	176	2.7
15. Crown Zellerbach	91	84	175	2.7
16. Weston Paper	135	—	135	2.1
17. Menasha	130	—	130	2.0
18. Continental Forest	119	—	119	1.8
19. Georgia-Pacific	118	—	118	1.8
20. Sonoco[1]	115	—	115	1.8
21. Manville Forest	115	—	115	1.8
22. Groveton Paper	105	—	105	1.6
23. Westvaco	95	—	95	1.5
24. Boise Cascade	95	—	95	1.5
25. James River	91	—	91	1.4
26. Harriman Paperboard	88	—	88	1.3
27. Newark Boxbaord	—	86	86	1.3
28. Louisiana-Pacific	80	—	80	1.2
29. Longview Fibre	70	—	70	1.1
30. Consolidated Packaging	65	—	65	1.0
31. Menominee Paper	—	52	52	0.8

U.S. capacity (1982): 6.565 million tons
Capacity share of top five companies: 36.8%
Capacity share of top ten companies 58.5%

[1] St. Regis interest in joint venture machine with Sonoco Products Co.

ANNUAL U.S. PRODUCTION OF CORRUGATING MEDIUM

(000 short tons)

	Semi-chemical[1]	Recycled[2]	Total	% change
1981	4717	1319	6036	0.5%
1980	4723	1281	6004	0.2
1979	4689	1301	5990	2.4
1978	4439	1408	5847	5.4
1977	4264	1286	5550	7.8
1976	4105	1040	5145	14.6
1975	3702	788	4490	−15.1
1974	4175	1115	5290	− 3.2
1973	4260	1204	5464	10.3
1972	4010	942	4952	8.1
1971	3700	879	4579	3.7
1970	3500	916	4416	—

1. Source: American Paper Institute
2. Source: Bureau of Commerce

ANNUAL U.S. CAPACITY FOR CORRUGATING MEDIUM

(000 short tons)

	Semi-chemical	Recycled	Total	% change
1984e	5566	1425	6991	1.4%
1983e	5477	1415	6892	4.9
1982e	5180	1385	6565	4.5
1981	4952	1332	6284	0.1
1980	4946	1330	6276	0.3
1979	4864	1392	6256	2.8
1978	4739	1343	6082	1.4
1977	4661	1337	5998	−3.8
1976	4758	1476	6234	4.2
1975	4536	1449	5985	3.5
1974	4430	1358	5788	4.0
1973	4386	1178	5564	6.6
1972	4155	1063	5218	5.6
1971	3938	1000	4938	2.2
1970	3847	983	4830	—

e = Estimated

Source: API

are 60 to 70 lb for 26-lb medium and 80 to 100 lb for 33-lb medium.

The bulk of corrugating medium (82%) is produced at 26 lb/1000 ft^2. Other grades produced are 22, 31, and 36 lb. Wet-strength grades are also made, mainly in 33- and 36-lb weights. Corrugating medium for conventional use is not sized. Hard sizing would interfere with starch gluing and result in poor adhesion between liner and medium.

Semichemical pulp and paper mills are located throughout the U.S. (42 mills) but installations in Canada are limited to mills in the eastern and maritime provinces. (Details on semichemical pulping are presented in the chapter covering pulping processes.)

PRODUCTION/CAPACITY TRENDS

Production of corrugating medium generally follows that of linerboard, with about one ton of medium currently used for every 2.22 tons of liner in producing corrugated containers (see linerboard section).

In 1981, production of corrugating medium grew by 0.5% over the 1980 level, with semichemical virtually flat and recycled medium up 3.0%, reflecting tight market conditions earlier in the year before box production began to fall off in the final quarter. Operating rates were also helped by 177,000 tons of inventory building during 1981, which left year-end box plant and mill stocks at a record 704,000 tons, equal to 7.8 weeks of supply—a high level but not as excessive as for linerboard.

Capacity for corrugating medium is expected to increase by 4.5% in 1982, 4.9% in 1983 and 2.4% in 1984. Most of the 715,000 tons of new capacity is expected to be in semichemical medium, while recycled capacity remains relatively flat. International Paper Co. started up a 270,000-tpy semichemical medium machine at its new Mansfield, La., mill at the end of 1981, and a 210,000-tpy machine is scheduled to come on line at MacMillan Bloedel's Pine Hill, Ala., mill in 1983. Actual semichemical medium growth, however, could prove to be less if IP's indefinite shutdown of its older 214,0000-tpy Bastrop, La., mill and Manville Forest Products' closure of a 106,000-tpy machine at West Monroe, La., remain permanent.

OUTLOOK

In 1982, total demand for corrugating medium is expected to total 5.6 million tons, down 7.1% from 1981. This is based on a projected 3.5% decline in corrugated container production which indicates requirements for corrugating medium of about 5.3 million tons. Estimated exports of 160,000 tons and other non-container uses of around 240,000 tons are expected to consume another 400,000 tons, offsetting about 100,000 tons of possible inventory reduction.

Recycled medium is expected to suffer more than twice the drop of semichemical medium production in this year's soft market.

U.S. PRICES FOR CORRUGATING MEDIUM

Semichemical, 26-lb

	\$ per short ton*	**\$ per 1000 ft^2**
1982		
2nd quarter	260/290	3.38/3.77
1st quarter	260/290	3.38/3.77
1981		
4th quarter	260/290	3.38/3.77
3rd quarter	290	3.77
2nd quarter	290	3.77
1st quarter	290	3.77
1980		
4th quarter	260	3.38
3rd quarter	260	3.38
2nd quarter	260	3.38
1st quarter	260	3.38
Year-end		
1979	240/260	3.16
1978	210/214	2.72
1977	190/194	2.45
1976	200/204	2.61
1975	190/200	2.55
1974	185	2.52
1973	135	1.80
1972	120	1.59
1971	110	1.43
1970	110	1.37

* List prices on West Coast were \$4.25 higher until first quarter of 1980, then an additional \$30/ton increase in price differential became effective.

Source: P&P WEEK, P&PW DATABOOK 1980

CANADIAN CONTAINERBOARD PRODUCTION

(000 metric tons)

	Total containerboard	Linerboard*	Corrugating medium*
1981	1574p	1087p	487p
1980	1671	1175	496
1979	1544	1078	466
1978	1419	1010	409
1977	1261	920	340
1976	1294	950	344
1975	1014	710	304
1974	1512	1091	420
1973	1450	1002	448
1972	1254	839	414
1971	1076	723	353
1970	1042	704	339

p = preliminary
* Includes some recycled paperboard.

Source: Statistics Canada

PRICING

Last $30/ton price increase for 26-lb semichemical medium to $290/ton took place at the beginning of 1981, but rebating in the industry took the price back down to $260 in December/January and back again to that level in late spring 1982 and into the seasonally weak summer months.

Pricing history of 26-lb semichemical medium in the East is as follows: 1970, $110/short ton; 1971, $120; 1972, $120; 1973, $135; 1974, $185; 1975, $190; 1976, $195; 1977, $185/195; 1978, $210; 1979, $260; 1980, $260; 1981, $290 list ($260 effective). West Coast prices have been higher, by $4.25 prior to the second quarter of 1980 and then by $34.25/ton until recently.

Semichemical medium is priced $10/ton less than 42-lb kraft linerboard (except on the West Coast) and recycled medium normally sells for about $5 less than semichemical. This pricing differential with linerboard may not fully reflect the lower fiber, chemical and capital costs of producing semichemical medium, indicating the latter grade is somewhat more profitable to produce.

CANADIAN CONTAINERBOARD MARKET

Canada is self-sufficient in containerboard production and a small net exporter of linerboard and corrugating medium.

Production in 1981 totaled 1.57 million metric tons of which 1.09 million tons consisted of linerboard and 487,000 tons was corrugating medium. Capacity has been relatively flat since the mid-1970s, reflecting marginal profitability of this grade, although the smaller Canadian containerboard market is highly concentrated, with the top three producers accounting for more than 60% of production. Around 20% of capacity consists of recycled paperboard made from wastepaper.

Exports of linerboard in 1981 totaled 256,000 tons, while exports of corrugating medium amounted to 103,000 tons. Eurocan Pulp & Paper is the largest liner exporter, accounting for roughly half of shipments, while Consolidated-Bathurst and Papier Cascade dominate medium exports.

Imports in recent years have accounted for only 2% to 3% of Canadian consumption but have an impact on domestic pricing levels. Most imports are specialty grades imported from the U.S.

Canadian manufacturers, however, may feel more competitive pressure, with linerboard tariffs scheduled to drop in stages from 13.6% in 1981 to 9.2% in 1987, while those on medium ratchet down from 12.3% to 4.0%. A further staged tariff reduction on linerboard to 6.5% by 1987 has been proposed.

ESTIMATED CONTAINERBOARD CAPACITY OF MAJOR CANADIAN PRODUCERS

Annual capacity (000 metric tons)

	Kraft liner-board	**Semi-chemical medium**	**Total container-board**	**Capacity share (%)**
Consolidated-Bathurst	200	120	320	21.2%
CIP	220	80	300	20.0
Domtar	230*	65	295	19.6
Eurocan	210	—	210	14.0
MacMillan Bloedel	110	70	190	12.6
Lake Utopia	—	90	90	6.0
Papier Cascades	—	85	85	5.7
Crown Zellerbach Canada	50	—	50	3.3

Canadian capacity (1982): 1.503 million tons

* Excludes 85(000) tpy of recycled linerboard capacity at Mississauga, Ont. Other smaller producers of recycled containerboard and their approximate capacities (000 tpy): Atlantic Packaging, 100; Kruger, 70; Belkin, 60; and Trent Valley, 45.

COATED & UNCOATED KRAFT BOARD

Unbleached kraft paperboard other than linerboard (also referred to as solid unbleached sulfate or SUS) is used for folding carton stock and other miscellaneous end uses. "Folding" includes clay-coated unbleached kraft and bleached-lined unbleached kraft backed paperboard for conversion into folding cartons and beverage carriers. "Other" includes miscellaneous uses for unbleached kraft board such as a filler in shipping containers; tube, can, and drum stock; file folder, tag, automotive panel, etc. These miscellaneous uses are discussed more fully in the section on Converted Products.

There is a considerable discrepancy between American Paper Institute 1981 statistics which place unbleached kraft folding-carton board production capacity at about 800,000 tons and Paperboard Packaging Council figures which indicate that about 390,000 tons of solid unbleached sulfate was consumed domestically in folding cartons and beverage carriers. Part of the difference reflects export shipments which totaled at least 55,000 tons in 1981 (with possibly more tonnage hidden in miscellaneous categories).

Clay-coated unbleached kraft board offers savings over solid bleached board and greater strength than clay-coated recycled board, and its use in folding cartons and carriers has been growing. According to PPC data, SUS accounted for 4.1% (117,000 tons) of total board used in folding cartons in 1960, rising to 13.1% (434,000 tons) of total in 1980 but declining to 11.9% (389,000 tons) in 1981 with further erosion expected in 1982 due mainly to the impact of the recession on beverage consumption and competition from other forms of packaging in the beverage market.

About three-fourths of folding carton SUS is consumed in carriers for holding cans or bottles, such as six-packs for beer or soft drinks and a wide range of food and other products. Carrier production in 1981 totaled 285,000 tons, which was down from about 300,000 tons in 1980 and the same level as in 1978. While SUS accounts for most of the board used in carriers, about 8% consists of solid bleached and about 3% of recycled board. Recycled board has been almost pushed out of the market since the introduction of coated unbleached kraft board in the late 1950s.

Carrierboard is coated on-machine, normally with a clay-coating over a calcium-carbonate precoat, and is made on conventional and modified fourdriniers.

UNBLEACHED KRAFT PAPERBOARD CAPACITY FOR FOLDING CARTONS AND OTHER USES

(000 short tons)

	Folding[1] cartons	Other[2] uses
1984e[3]	806	563
1983e[3]	798	556
1982e[3]	790	547
1981	804	540
1980	852	529
1979	827	520
1978	650	540
1977	645	561
1976	595	525

1. Includes carrier board.
2. Includes tube, can and drum stock.
3. Capacity will be lower if two Manville Forest machines with 150,000 tpy of capacity remain permanently shut down.

Source: American Paper Institute

Carrier stock used in chilled applications is made with wet-strength additives either in the kraft furnish or coating or both. Typically, carrier stock has a basis weight of about 84 lb/1000 ft^2 and 410 g/m^2 and a caliper of 20 to 21 pt (0.021-0.022 in.).

Manville Forest Products and Mead Corp. together hold about an 80% to 90% share of the carrierboard market. With the indefinite shutdown of two older machines at its West Monroe, La., mill in mid-1982, Manville has capacity to produce about 355,000 tpy of clay-coated kraft board on two remaining machines. Most of this consists of carrierboard, although the company in 1978 started up a 256-in.-wide Tampella machine with two fourdriniers and two Arcu-Forma twin-wire formers designed to produce a low-density folding cartonboard. After considerable startup difficulty, the No. 7 machine is turning out some .014- to .024-in. cartonboard being marketed under the name "Pearl-Kote" which is finding use in packaging hardware, toys, sporting equipment, frozen foods, soap, and paper goods.

Mead (through its 50%-owned Georgia Kraft Co. affiliate) produces clay-coated carrier stock at Mahrt, Ala., on a 262-in.-wide fourdrinier machine, which has a total capacity of 360,000 tpy, with about 180,000 tpy used for clay-coated board and the balance for linerboard. The largest producer of clay-coated recycled carrier board is Federal Paper Board Corp., which now makes only about 6000 to 7000 tpy at its Los Angeles, Calif., mill.

The outlook for clay-coated kraft carrierboard is highly uncertain because of intensive competition from alternate packaging systems, particularly plastic ring-handles for six-packs of aluminum cans. Liter-size plastic bottles have also been replacing smaller bottles for soft drinks which might have been carried in six-pack paperboard carriers. The Plasti-Shield bottle with a plastic carrier introduced by Owens-Illinois five years ago has also been growing in market share (5.2 billion bottles shipped in 1981).

Helping demand for paperboard carriers has been increasing popularity of 12-packs for beer and the growth of premium beer brands and mineral water which are normally sold in bottles.

Environmental pressures have caused a few states, such as Michigan, Oregon, and possibly California (if a November 1982 referendum is approved), to pass laws imposing deposit taxes or outlawing disposable cans and bottles. These laws are aimed at encouraging use of returnable bottles and the returning of aluminum cans, and should result in the use of more paperboard carriers.

BEVERAGE CARRIER PAPERBOARD STOCK

	Production (000 tons)	Shipment value ($ million)	Realization value ($/ton)
1981	285	—	—
1980	300	—	—
1979	295	—	—
1978	285	198.1	695
1977	246	167.0	679
1976	239	150.8	631
1975	235	144.1	613
1974	208	114.4	550
1973	198	92.7	468
1972	194	84.2	434
1971	196	83.9	428
1970	223	92.1	413
1969	251	97.9	390

Source: Paperboard Packaging Council

BLEACHED BOARD

GRADE STRUCTURE

Solid bleached sulfate (SBS) paperboard is made from a furnish containing at least 80% virgin bleached woodpulp. Its uses are many and varied but the principal markets are folding boxboard and milk carton stock. The other grades include cup stock; plate, dish and tray stock; and bleached linerboard. An undetermined number of SBS producers also make bristols, which can be difficult to differentiate from SBS (see chapter on Bristols in section on paper grades).

About 50% of bleached boards are coated. Coating formulas vary according to the desired surface requirements and degree of sheet holdout (resistance to liquids). Additives are also mixed in with the stock furnish to give the sheet certain characteristics. In making folding carton, for example, a 5-lb/3000-ft^2 coat weight—typically a clay coating using a S-B latex as binder—is usually added to the stock. Acrylic binders are also commonly used. In milk carton furnish, synthetic waxes are added to improve holdout properties.

Bleached boards are made in calipers ranging from 10 pt to 28 pt and in three levels of apparent density. Basis weights range from 120 to 300 lb/3000 ft^2. Sheet density, which is the basis weight divided by caliper, starts at 10.5 lb/pt (lb/pt of caliper on 3000-ft^2 basis) or less for low-density board such as high-quality folding carton, and goes to 12.0 or more for high-density board. Medium-density board is considered to be in the 10.5 to 12.0 range.

A blend of softwoods and hardwoods in about equal proportions is used to make SBS board. The mix is varied depending on strength, density and printability requirements. For example, softwood content would be higher for milk carton stock because of superior tear and tensile strength requirements.

SBS board is typically made on a conventional fourdrinier, a flat-forming suction type, with a secondary headbox commonly included.

Multi-fourdrinier paper machines, which combine a series of fourdrinier sections on a single machine, are in limited use. They make a composite board known as multi-fourdrinier board (MFB) that is derived from bleached kraft pulp and thermomechanical (TMP) pulp. Bleached kraft is used to make top and bottom layers of MFB. TMP pulp is used for the middle plies. TMP pulp is slightly cream colored, but can give paperboard the appearance of bleached board. The stiffness of MFB may not be any greater than SBS, but its cost is generally lower due to TMP substitution. Another advantage of multi-fourdiniers compared to conventional fourdriniers is the capability to make thicker boards than possible on single fourdriniers.

The only known U.S. bleached board producer making MFB from TMP is Continental Forest Industries.

U.S. STATISTICS FOR BLEACHED BOARD

	1980	1981	1982e
Production, 000 tons[1]	3862	3910	3700
Capacity, 000 tons	4180	4015	4049
Utilization rate, %	92.4	97.4	90.1
Exports, 000 tons	606	584	580
Imports, 000 tons	—	—	—
Apparent U.S. consumption			
000 tons	3256	3326	3120
lb/capita	29.25	29.56	27.55
000 tons/$ billion real GNP (1972)	2.20	2.20	2.06

e = Estimated

1. All tons are short tons

At its Augusta, Ga., mill, a Voith multi-fourdrinier produces a four-ply coated bleached boxboard using TMP for two filler layers and bleached kraft for two outside plies. A main fourdrinier section lays down the bottom ply from bleached kraft. Farther down the wire, two Voith Compact formers apply filler plies of TMP pulp, and the top liner of bleached kraft pulp is also applied with a Compact former.

Machines making high-gloss board use gloss calenders to improve the finish. Most machines use on-machine coaters; but milk carton stock is extrusion-coated off the paper machine, normally at the paper mill.

The majority of SBS board machines trim at around 200 in.; in some cases trim may be as high as 275 in. and as low as 118 in. High-capacity machines are normally dedicated to the production of milk carton stock.

INDUSTRY STRUCTURE

Many bleached board producers have the capability to switch from making SBS board to bristols or market pulp in either rolls (fluff pulp) or in bales. This enables production to be adjusted to market conditions, allowing producers to take advantage of more profitable markets. Between 1980 and 1981, capacity for bleached boards declined by 165,000 tons due to allocation of machine time to making market pulp, according to the American Paper Institute.

This considerable swing capability makes it difficult to determine SBS capacity accurately, and it is felt that capacity is slightly higher than reported. An executive at a major producer estimates 61% of bleached board capacity is generally dedicated to bleached board, 14% to bristols, 3% to pulp, and 22% constitutes swing capacity.

Another impediment to making an accurate assessment of SBS capacity has been a reduction in basis weight and density requirements of SBS board in recent years due to more sophisticated technology. It is possible now to make a lower-density board with comparable stiffness and quality to a higher-density board of several years ago. This has enabled producers to make more units of product from a ton of board, and some observers believe this trend has caused relatively flat tonnage production figures to mask an increase in unit production levels.

Capacity trends. From 1970 to 1980, bleached board capacity grew at a 1.7% average annual rate, but decreased 3.9% in 1981 from 1980, contributing to a higher operating rate of about 98% in 1981 from 96% in 1980. In 1982, about 30 machines with a capacity of 4.05 million tpy were in operation, according to API.

Industry capacity is expected to increase to 4.14 million tpy by 1984, with most of the hike attributed to the completion of International Paper Co.'s 100,000-tpy increase in bleached board production at Texarkana, Tex. (One bleached board machine at Texarkana was actually installed originally in the 1970s as an SBS unit but has been employed largely to produce market pulp; as part of the reconfiguration of IP's Georgetown, S.C., mill, pulp output will be shifted to Georgetown in the next two to three years while the Texarkana machine will be redeployed to make SBS.) International Paper estimates that total industry SBS capacity will rise by 123,000 tpy from 1982 through 1987.

Pricing and profitability. Except for some of the smaller machines, the efficiency of most paper machines is good; however, many machines are integrated into mills with poor economics, either due to labor or equipment.

SBS board mills in the past have been profitable even when they theoretically would have appeared to be inefficient in design or location, since aggressive pricing and inadequate supply have kept operating rates high. Swing capability has also allowed SBS machines in times of tight pulp supply to produce pulp—which is more profitable to make than bleached board since the economics of the two products are similar except for the higher conversion costs of SBS.

The price of SBS in real terms has more than doubled since 1972. Prices increased 6% to 7% in June and July of 1981 and this increase held, although some discounting occurred. Prices are expected to continue to rise in coming years, although at a somewhat slower pace than the recent historical rate, unless demand increases or supply decreases more than expected. Prices should keep pace with inflation, which has also slowed, and increases should be around 6% to 8% a year, observers say.

MARKETS

Largest end-use for SBS board is in folding cartons, accounting for 43% of total production in 1981. Milk carton stock made up about 22% of the market; cup and container, 11%; exports, 11%; plate, dish, and tray, 7%; linerboard, 2%; and other packaging and nonpackaging uses, 4%.

Virtually every end-use for SBS paperboard was suffering in the recession, with overall production down 6.5% during the first half of 1982 from the same period in 1981. SBS production for export dropped 6.1% for the first four months of 1982. Operating rates, which were around 93% in mid-1982, were expected to rise to about 95% for the year, and gradually increase to 100% by 1984.

In 1981 the market did reasonably well. Production of SBS board increased 1.2% to 3.91 million tons from 3.86 million tons in 1980, which had been a drop from the previous year, according to API. Production rose at a 1%/year rate from 1970 to 1980.

Domestic production of **folding carton** board through April 1982 was down 5%, due to a gain in market share by recycled paperboard, made more competitive by low wastepaper costs. Exports of folding carton dropped 26% to 38,000 tons during that period.

Government figures indicate that bleached board remained the leading grade consumed in the folding box

U.S. CAPACITY FOR BLEACHED BOARDS

(000 short tons)

	Liner-board	Folding	Milk carton & food service	Other	Total	% change
1984e	108	1921	1777	231	4037	−0.3
1983e	108	1923	1786	230	4048	−0.02
1982e	108	1919	1794	228	4049	+0.8
1981	108	1904	1774	229	4015	−4.0
1980	116	1954	1865	246	4180	−3.2
1979	133	2080	1916	189	4318	2.9
1978	122	1996	1899	179	4197	4.4
1977	97	1930	1824	170	4020	0.6
1976	101	1915	1854	128	3998	5.0
1975	95	1751	1859	102	3807	−2.9
1974	108	1851	1848	113	3920	−0.2
1973	141	1749	1899	139	3928	3.7
1972	134	1583	1937	134	3788	6.1
1971	143	1455	1842	128	3569	2.8
1970	130	1406	1739	197	2472	−2.4
1969	150	1500	1689	218	3557	—

e = estimate

Source: American Paper Institute

BLEACHED BOARD PRODUCTION BY END USES[1]

(000 short tons)

		Cartons		Heavy-weight cup stock	Plate, dish and tray	Liner-board	Other food packag-ing	Misc. packag-ing[2]
	Total	Folding	Milk					
1981	4109	1976	1039	427	269	—	—	47
1980	4026	2063	1015	401	263	—	—	40
1979	3883	1999	1090	341	232	102e	—	119
1978	4002	1934	1048	400	277	159e	—	184
1977	3882	1822	1040	419	296	92	53	160
1976	3876	1880	1050	370	267	103	23	183
1975	3420	1540	1052	329	274	88	—	137
1974	3827	1706	1055	442	322	104	—	198
1972	3741	1637	1006	389	350	139	—	220
1970	3404	1395	971	369	317	133	—	219

e Estimate
1. Production for both foreign and domestic uses
2. Includes other food packaging when not included in separate category 1970-1979

Source: Bureau of the Census

industry in 1981, despite continuing weakness in its principal end-user market, wet foods. In 1981 the industry's consumption of SBS accounted for 37.5% of the total 3.4 million tons of folding boxboard consumed, about the same as in the previous year, according to the Bureau of Industrial Economics.

Paperboard Packaging Council figures, however, indicate that clay-coated newsback, which has been running neck-to-neck with SBS board in the folding carton market in recent year, increased 7.8% in 1981, accounting for 39% of all folding carton shipments, while bleached board shipments dropped 4.5%, accounting for 36% of folding carton shipments in 1981.

(The disparity in the figures is due to different sources being used to compile the statistics, according to a government official. The government uses numbers based on information provided by producers, while PPC uses figures based on contact with consumers.)

SBS and other virgin kraft board together accounted for slightly over 50% of the industry's board consumption in 1981, compared to only 43% in 1972, according to BIE.

Most of the growing use of virgin board in folding box manufacturing over the past decade has been the result of significantly increased demand for kraft board, especially in beverage carrier end-use and in packaging of toys, cosmetics, and certain food applications. SBS use during the early 1970s also expanded rapidly but has since leveled off, the bureau notes.

The price differential between SBS and clay-coated recycled board widened from $70 to $80 a ton in the late 1970s to $150 a ton by January 1982, when the list price of a ton of 15-pt coated SBS board was quoted at $625, although some regional discounting was reported.

Liquid packaging board has been about the weakest segment of the SBS board industry in the domestic market. **Milk carton** stock sales have declined 5% a year in the last five years, according to figures from a major producer. In an attempt to restore some of the milk container market share that paperboard has lost to plastic, the PPC launched a national campaign in 1982 to publicize the nutritional advantages of using paperboard containers for milk. The gist of the campaign is a claim that paperboard containers don't allow light in to rob milk of its vitamins, as plastic and glass allegedly do.

BIE figures indicate that sales of paperboard milk cartons accounted for about 16.5% of the total value of 1981 **sanitary food container** shipments compared to about 22% of the 1972 total, with a decline of more than 30% in tonnage over the 1972-81 period. Domestic milk carton stock output was down by 6.5% through April 1982 compared with the first four months of 1981. While the short-term decline was caused partly by the 1981-82 recession, most of the loss long-term is attributed to a significant portion of the traditional milk carton market being lost to plastic containers, particularly the gallon size. In addition, overall milk consumption is down because families are having fewer

CAPACITY FOR BLEACHED BOARDS OF MAJOR U.S. COMPANIES

	Annual capacity (000 tons[1])	Capacity share (%)
1. International Paper Co.	950	23.5
2. Potlatch Corp.	508	12.5
3. Westvaco Corp.	410	10.1
4. Continental Forest Industries	370	9.1
5. Federal Paper Board Co.	330	8.1
6. Temple-Eastex Inc.	310	7.7
7. Champion International	245	6.1
8. James River[2]	200	4.9
9. Weyerhaeuser Co.	200	4.9
10. Container Corp. of America	170	4.2
11. Georgia-Pacific Corp.	150	3.7
12. Gilman Paper Co.	150	3.7
13. Gulf States Paper Corp.	150	3.7
14. Mead Corp.	110	2.7
15. Union Camp Corp.	90	2.2
16. St. Regis Paper Co.	50	1.2

Total U.S. capacity (1982): 4.049 million tons
Capacity share of top five companies: 63.4%
Capacity share of top ten companies: 91.2%

1. Short tons
2. Formerly American Can Co.

U.S. BLEACHED BOARD PRODUCTION

	Tonnage (000 short tons)	% change
1982e	3819	− 2.3
1981	3910	+ 1.2
1980	3862	− 3.4
1979	3998	+ 0.6
1978	3972	+ 6.9
1977	3717	− 3.1
1976	3838	+14.9
1975	3341	−11.4
1974	3769	− 2.1
1973	3852	+ 3.9
1972	3709	+ 8.8
1971	3408	+ 1.1
1970	3372	− 5.3
1969	3560	—

e = estimate

U.S. BLEACHED BOARD EXPORTS[1]

(short tons)

	API[2]	Census
1981	557,000	767,412
1980	545,000	606,000
1979	466,000	508,000
1978	430,000	440,723
1977	389,000	374,823
1976	306,000	352,638
1975	—	284,203
1974	—	374,642
1973	—	265,169
1972	—	208,516
1971	—	183,257
1970	—	129,139
1969	—	131,946

1. Imports are minor
2. API data represents production for export, not shipments

Source: API and Bureau of Census

U.S. PRICES FOR BLEACHED KRAFT BOARD

($/short ton)

Year-end	15-pt, folding carton, C1S 80 bright (rolls)	Cup stock, uncoated
1982e	625	n.a.
1981	625	n.a.
1980	518	n.a.
1979	490	457/468
1978	445	406
1977	405	386
1976	385	364
1975	355	342
1974	350	n.a.
1973	250	n.a.
1972	192	n.a.

Source: P&P WEEK

children and people are reducing caloric and cholesterol intake, the bureau notes.

Export demand for milk cartons, however, has been on the rise, offsetting some of the loss in domestic demand. In 1981, milk carton exports and other food service board were up 1.7% to 141,000 tons, according to BIE.

In addition, an increase in sales of domestic **paperboard cans** has also bolstered the liquid paperboard container market. Sales of **juice containers** have expanded at a rate of 8% to 10% in the past five years, and by an estimated 8.5% in 1981. The market is currently about 70,000 tpy in magnitude, according to one producer.

Demand for paperboard cans overall increased 2.1%/year in the last five years, according to a major producer. Paperboard cans are mostly used for dry foods such as snacks, and are also suitable for packaging greasy foods, pet foods, powdered drink mixes, yogurt and ice cream.

In 1981, an estimated 450,000 tons of heavyweight **cup stock** was produced, up by about 15% from the previous year, according to BIE. The growth in paper cup sales over the past decade was achieved partly through improved moisture resistance and competitive pricing, despite stiff competition from plastic substitutes, the bureau notes. Cup stock reportedly dropped 21% during the first four months of 1982, however, according to one observer.

Output of bleached paperboard for **plates**, **dishes** and **other food service** items declined by more than one-third during the 1972-81 decade to about 224,000 tons in 1981, and had reportedly dropped 8% during the first four months of 1982. The steady downward trend in the plate, dish and food service market was the result of significantly reduced paperboard demand by converting facilities, declining end-user markets and use of thinner-caliper board, according to government analysts.

Overseas demand for sanitary food containers, however, did remarkably well in 1981, climbing by almost 50% in value to a total of $95 million, according to BIE. **Imports** of sanitary food containers remained relatively small, totaling about $5 million in 1981.

Principal **export** markets for U.S. sanitary food containers during 1981 include South Korea, Argentina and Denmark for milk and other beverage containers; United Kingdom for cups; and Canada and Mexico for plates and trays, according to government reports.

One of the newer markets for bleached boards is as **ovenable paperboard** trays, which can be used in both conventional and microwave ovens up to 400°F. Government figures indicate about 800 million ovenable board food trays—double the 1979 amount—were produced in 1980, and as many as 2 billion ovenable food trays were made in 1981. An estimated 50,000 tons of bleached board were used in ovenable board manufacture in 1981, according to the bureau, although one industry estimate places consumption at only

10,000 tpy and growing to 70,000 tpy by 1986—considerably below earlier optimistic forecasts that saw a market of 200,000 tpy developing by the mid-1980s.

Sales of ovenable paperboard remained strong in 1981 despite the economic recession, due to increasing popularity of oven-ready meals and the growth in fast-food restaurants, which together have created a market for a inexpensive heat- and cold-resistant packaging medium for prepared foods.

The newest potentially important market for U.S. SBS board is in **aseptic packaging**, which is used to keep perishables such as milk and juice fresh without refrigeration for up to six months. This is done by sterilizing the food and then hermetically sealing it in multi-ply paperboard/foil/polyethylene containers. Aseptic packages have been used in Europe for a number of years, but were only introduced into the U.S. market in 1981 when the Food and Drug Administration approved the use of hydrogen peroxide as a sterilizing agent.

Demand for aseptic packaging in the U.S. is expected to be 40,000 to 50,000 tpy by 1987, some observers believe.

Cost of aseptic packaging has been estimated at 40% of that of glass bottles and metal cans, but is more expensive than conventional gable-top cartons or plastic bottles. Both clay-coated multi-ply paperboard and SBS are used by packaging innovator Tetra Pak of Sweden, depending on whether or not flexographic or rotogravure printing is used.

Major food producers such as Borden, Coca-Cola Food, Del Monte and Ocean Spray are test-marketing products in these containers around the world. Leading this market has been Brik Pak Inc., a Dallas-based subsidiary of Sweden's Tetra Pak International. Machines of this company were expected to start operating in late 1982. Other suppliers of carton-filling machines are Bloc-Pak Inc., a Toronto-based subsidiary of West Germany's PKL GmbH, and International Paper Co.

OUTLOOK

Overall SBS board production is expected to remain stable in traditional markets and pick up somewhat in export markets in next five years. The lack of any major expansion plans in the industry should keep the market relatively tight for the next five years once the economy recovers.

Recession recovery. It is projected by one consulting firm that SBS production will decline by 3% in 1982 from 1981 but then increase at the following rates through 1985: 3.6% in 1983, 1.4% in 1984 and 2.3% in 1985.

SUMMARY OF SANITARY FOOD CONTAINER INDUSTRY STATISTICS

(SIC Code 2654)

	Plants (total)	Employees	Value of shipments[1] ($ million)	Capital expenditures ($ million)
1982e	—	27,800	—	—
1981e	193	26,700	2,949	—
1980	—	27,400	2,628	—
1979	—	29,800	2,328	65.7
1978	—	28,900	2,086	71.5
1977	194	28,700	2,048	52.4
1976	—	30,600	1,982	53.8
1975	—	28,300	1,775	29.6
1974	—	30,800	1,652	44.5
1973	—	—	1,448	38.0
1972	250	35,100	1,420	42.3
1971	—	—	1,256	33.8
1970	—	—	1,214	39.8

1. Value of industry shipments, not products
e = estimated by Census or P&P

Source: Census of Manufactures

U.S. SANITARY FOOD CONTAINERS INDUSTRY: VALUE OF SHIPMENTS AND CONSUMPTION OF PAPER AND BOARD

	1977		1972	
	Paper & board consumed (000 sh ton)	**Value of products ($ million)**	**Paper & board consumed (000 sh ton)**	**Value of products ($ million)**
Total: (SIC Code 2654)	—[1]	1,951.7	—[1]	1,381.4
Milk and milk-type cartons[2]	751	479	894	316
Cups and liquid-tight containers	—	606	—	459
Liquid-tight containers[3]	35	41	103	92
Drinking cups[4]	600	565	428	354
Cups[5]	—	—	—	13
Other sanitary food containers[6]	—	831	—	592
Food serving products				
Stamped plates, dishes, spoons etc.	216	173	233	99
Other paperboard items	73	43	136	57
Other paper items[7]	21	16	40	18
Containers for liquid[8]				
Frozen foods and bakery[9]	428	341	460	216
Butter and ice cream packaging and food pails	183	138	187	100
Processed meats, margarine[10]	73	70	123	59
Trays and boards[11]	66	46	76	25
Others	—	50	—	33

1. Data not collected or available
2. Including juices, beverages, and other products
3. Plus round nested food containers, including lids and tops
4. Plus portion serving cups
5. And liquid-tight containers not classified
6. Includes food containers, boards, and trays
7. Includes tablecloths and soda straws, except glass or plastic
8. Containers for liquid, moist, oily, or perishable foods, including frozen foods
9. Including frozen bakery
10. Plus lard and shortening
11. For fresh meat, poultry, and produce for retail packaging.

Source: 1977 Census of Manufactures

SBS board production is expected to reach 3.8 million tons in 1982, down from the 4.1 million reported in Bureau of Census figures for 1981. According to one estimate production should reach to 4.9 million by 1994, with exports growing by 6.5% a year for next five years.

Any SBS recovery from the short-term ills brought on by the recession of 1981-82 will depend largely on how fast the recovery leads to an improvement in discretionary consumer income, since so many SBS end-uses are tied to discretionary consumer decision-making. Folding carton is expected to be the first SBS grade to recover from the economic slump of 1981-82, according to one observer, who felt that demand for frozen foods and convenience foods would spring back with the economy and boost sales of SBS board.

Despite an expected continuation in 1982 of the long-term downtrend in paperboard's share of the milk container market due to competition from plastics, shipments of sanitary food containers are expected to total $1.28 billion (measured in 1972 dollars) in 1982, a 1.5% increase from 1981 due primarily to continued strength in paper cup and ovenable paperboard tray sales. This growth, however, is slightly less than forecast for the entire paper and allied products industry in 1982, according to BIE. The sanitary food container industry is expected to grow 2%/year during 1981-86.

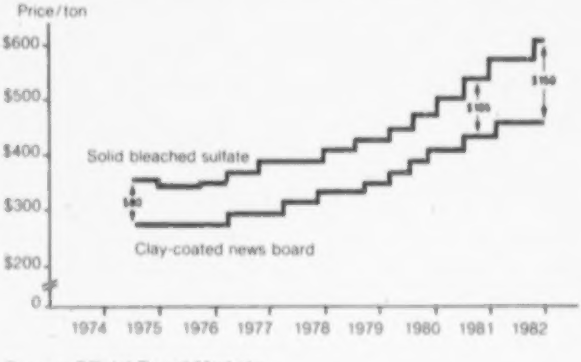
Overseas markets. Exports of SBS board, which have increased in recent years, particularly in milk carton stock, are expected to decline in 1982. For 1983 and beyond, however, this remains a potential growth area. Many foreign countries are switching from glass to paperboard cartons for milk containers. Plastics provide less competition overseas than in the U.S. market because their production in many areas is limited, observers say.

A growth in exports of milk cartons, which is estimated at 5% a year for the next five years, is expected to outweigh a projected decline in domestic sales of about 4% a year for the next five years, giving the market a net gain of 1% a year, according to International Paper Co.'s Glen Dell. Some observers feel the decline in domestic liquid paperboard packaging, particularly milk cartons, has already leveled off, and forsee growth in such areas as juice cartons.

Dell estimates that the Japanese market for milk carton stock should grow by 6% to 7% a year, while European demand—spurred by a belated United Kingdom conversion from glass to paperboard and recent jumps in milk consumption in West Germany—is expected to grow at the rate of 5% to 6% a year.

Demand for paperboard juice containers is expected to increase 8% to 10% a year, according to a major manufacturer's estimates. Producers are also enthusiastic about growth projections for paperboard cans, particularly in the export market.

FOLDING BOXBOARD PRICE TRENDS



Source: Official Board Markets

Other food service products. The industry's losses in the domestic market for liquid foodboard should also be somewhat offset by an expected increase in cups, plates, dishes and other paper food-serving items, as well as milk cartons. Latin America is expected to take the largest market share of the industry's overseas deliveries through 1986, with Asian demand expected to expand considerably during the period, according to BIE.

Plate, cup, dish and tray markets are considered to be fairly mature except in the fast-food industry, according to BIE. As more fast-food producers move overseas, export demand should increase, however. Domestic demand for SBS board from the U.S. fast-food industry has been consistently strong and is growing, the bureau notes. Depressed resin prices, however, have made plastics a major competitor in this market.

SBS vs recycled. Clay-coated folding recycled paperboard is expected to continue to provide stiff competition for solid bleached in the boxboard market, according to the Paperboard Packaging Council.

Some industry observers feel SBS board production will decline in 1982 due primarily to recycled paperboard's competitive pricing advantages from reduced wastepaper costs. One SBS manufacturer also noted that dry foods, traditionally packaged in recycled board, do better in a recession than do frozen foods, which are traditionally packaged in SBS.

Other observers feel once secondary fiber costs increase, recycled board producers will be forced to raise prices to a level which will restore vitality to the bleached board market. BIE expects that more folding boxes will be used in frozen food in the period 1981-86 at the expense of aluminum trays, and that should also benefit the SBS market.

SBS producer are also able to reduce their energy costs through installation of woodwaste-burning boilers, while recycled mills must rely entirely on purchased energy which may again begin to rise rapidly in cost.

RECYCLED PAPERBOARD

INDUSTRY STRUCTURE

Recycled paperboard usually is made entirely from wastepaper, and is produced on both fourdrinier and multi-ply paper machines. Mills tend to be small, with old equipment that is slower and less efficient than machines used in other sectors of the paper industry. Most recycled mills, however, are close to their markets and can offer a high degree of service to customers. This also enables them to cut costs for freight and wastepaper.

Grades of recycled paperboard are divided into the three categories of (1) folding boxboard, (2) setup boxboard, and (3) paperboard. Most folding boxboard is clay-coated, while most setup boxboard is uncoated. Recycled paperboard includes corrugating medium, linerboard, gypsum linerboard, core, can and tube stock but does not include any construction papers or boards.

Boxboard grades usually consist of four or more plies. The top layer is made from deinked pulp or other high-quality wastepaper such as pulp substitutes. Middle plies are made with lower quality paper stock such as old news and mixed papers combined with some old corrugated containers for more strength. The fiber content of the bottom layer, or back ply, depends on the strength and appearance sought in the finished product, and fiber choices would include news, corrugated and pulp substitutes.

GENERAL OUTLOOK AND MARKETS

Market shares of recycled paperboard as measured by 1982 capacity are as follows: folding boxboard, 30%; setup boxboard, 4%; corrugating medium, 16%; gypsum linerboard, 15%; linerboard, 6%; container chip and filler board, 3%; other paperboard, 26%. Other paperboard includes uses such as tube, can, drum, tag, file folder, match stem, tablet backs, and toys.

Operating rates in recycled paperboard remained at about 82% in 1980 and 1981 and were expected to drop to about 78% or 79% in 1982 before gradually rising to 80% in 1983 and 82% in 1984, analysts indicate. They estimate that production of recycled paperboard will drop to 6.9 million tpy in 1982 from 7 million in 1980 and 1981, and will rise again to 7.1 million in 1983 and 7.3 million in 1984.

More capacity has been retired from recycled paperboard then in any other sector of the industry, with more than 2.7 million short tpy, or 34%, of recycled paperboard taken out of production since 1970. Machine rebuilds have offset the losses, however, and capacity has remained relatively flat for many years.

Recycled paperboard capacity is expected to grow by 352,000 tpy in the years 1982-84, according to the American Paper Institute. This will bring recycled paperboard capacity to 8.9 million tons by 1985, unless

U.S. STATISTICS FOR RECYCLED BOXBOARD AND PAPERBOARD

	1979	1980	1981
Production[1], 000 tons[2]	7591	7071	7070
Capacity, 000 tons	8757	8617	8593
Utilization rate, %	87.6	82.1	82.3
Imports, 000 tons	23	22	30
Export, 000 tons	176	249	174
Apparent U.S. consumption			
000 tons	7438	6844	6926
lb/capita	66.1	60.1	60.3
000 tons/$ billion real GNP (1972)	5.02	4.62	4.59

1. American Paper Institute data
2. All tons are short tons

415,000 tpy of capacity now idled indefinitely is shut down permanently.

One of the largest individual reductions in production capacity occurred in 1980 when Whippany Paper Board Co. declared bankruptcy and idled 450,000 tpy of recycled linerboard, corrugating medium, uncoated paperboard and specialty paperboard production. The 72,000-tpy Riegelsville, Pa., linerboard and specialty paperboard mill, however, was bought in 1981 by a new corporation called Durham Mills Inc., with the intention to upgrade and expand the mill to produce 135,000 tpy, starting in the summer of 1982.

The competitiveness of recycled paperboard mills continues to be affected by high energy costs (since they have no spent pulping liquors or woodwastes to burn) and fluctuations in wastepaper costs. The sharp decline in wastepaper prices during the recent 1982 recession has helped overall manufacturing costs and enabled mills to remain marginally profitable and in a stronger competitive position vs virgin board.

RECYCLED FOLDING BOXBOARD

Clay-coated grades have a dominant share of the recycled boxboard market and accounted for 36% of all folding boxboard produced in 1981, according to Commerce Dept. data. Other recycled folding boxboard grades such as uncoated bending chip and white and kraft-lined grades accounted for less than 15% of total folding boxboard output and have been in a long-term decline (down from 25% in 1972). The remainder of the folding boxboard market consists of solid bleached sulfate (SBS) and other solid unbleached sulfate (SUS) grades made mainly from virgin fiber.

Clay-coated recycled boxboard, which is coated on only one side on an on-machine coater, is used in dry food containers such as cereal boxes, dry soap boxes, frozen food boxes, and packaging and non-food products either directly or indirectly.

Quality and productivity have been upgraded in a number of folding boxboard mills by replacing inefficient cylinder board machines with multi-ply formers. Formers such as the Ultra Former have enabled mills to compete more effectively with coated solid bleached board—the major competitor of clay-coated. A lower-density sheet can be produced on these formers than on a conventional cylinder machine, 3.9 to 4.2 lb/pt vs 3.4 to 3.8 lb/pt with newer formers.

In recent years, coated recycled boxboard grades have been able to compete more effectively against solid bleached boards. Since 1974, the ratio of folding boxboard produced from recycled remained nearly the same and may have recently improved slightly with some recycled-boxboard-dominated applications such as dry food packaging holding up better through the recession than some heavy SBS uses such as frozen food cartons. Nonetheless, coated recycled boxboard will continue to be on the defensive, especially for low- and medium-density boards.

ANNUAL U.S. CAPACITY FOR RECYCLED FOLDING AND SETUP BOXBOARDS

(000 short tons)

	Folding	Setup
1983e	2689	362
1982e	2657	352
1981	2638	321
1980	2593	349
1978	2568	418
1976	2705	450
1974	2665	505
1972	2607	502
1970	2805	576
1969	3029	577

e = estimated

Source: American Paper Institute

U.S. DOMESTIC PRODUCTION OF FOLDING BOXBOARD FROM RECYCLED FURNISH AND SOLID BLEACHED AND UNBLEACHED BOARDS

(000 short tons)

	Recycled	Solid	Ratio (recycled/ solid)
1980	2235	2260	0.99
1978	2321	2384	0.97
1977	2367	2179	1.09
1976	2340	2375	0.99
1974	2281	2146	1.06
1972	2477	1962	1.26
1970	2473	1607	1.54
1965	2659	1220	2.18

Source: American Paper Institute

Two companies—Continental Forest Industries and Manville Forest Products—also produce large amounts of folding boxboard from virgin fiber. On a Voith-designed multi-former of 240-in. width, CFI in its Augusta, Ga., mill can produce up to 150,000 tpy of coated folding boxboard from a furnish of TMP and bleached kraft pulp. This machine is now producing a coated boxboard, competing on the lower end of the boxboard market directly against lower-caliper recycled boxboard and lower-quality solid bleached boards.

Manville is using a Tampella-designed former to produce a coated boxboard grade from a high-yield kraft pulp at its West Monroe, La., mill. This approach is similar to that used by Manville to produce carrier stock. The company reportedly has had difficulty being able to produce a completely acceptable folding boxboard grade on this machine. However, both of these machines have the potential of capturing a large share of the existing market for folding boxboard. Since this market has not been growing, it appears less-efficient boxboard mills will be squeezed out of the market.

RECYCLED SETUP BOXBOARD

Preformed boxes are the primary usage for setup boxboard, also called nonbending paperboard or boxboard. Grades include plain chipboard, news

RECYCLED COMBINATION PAPERBOARD, BOXBOARD, AND PACKAGING GRADES

Album board
Automobile board
Bending chipboard
Blister board
Can stock
Car lining board
Chipboard
Cracker shell board
Core stock
Corrugating medium
Drum stock
Florist board
Innersole
Jute board
Kraft-backed board
Laminating board
Lined board
Manila board
Matchbook board
Mat-finishing board
Moistureproof board
Mounting board
Newsboard
Offset blanks
Patent-coated
Pasteboard
Photo-mount board
Poster board
Pulpboard
Saturating board
Shoeboard
Test chipboard
Test linerboard
Transformer board
Tube stock
Wallboard
Water resistant board
Waterproof board
Wet strength board
White-lined board

U.S. PRODUCTION OF BOXBOARD GRADES —FOLDING AND SETUP

(000 short tons)

		Recycled folding boxboard[1]				
	Total	Unlined chipboard	Kraft lined	White lined	Clay coated	Recycled setup boxboard[2]
1981	2297	—[3]	—[3]	—[3]	—[3]	511
1980	2350	606	81	220	1443	560
1979	2386	678	98	229	1380	604
1978	2469	706	131	247	1384	687
1977	2423	687	133	274	1330	717
1976	2508	707	145	313	1343	747
1975	2108	564	124	274	1146	672
1974	2423	697	137	439	1149	796
1973	2652	740	146	520	1246	998
1972	2656	793	140	533	1190	985
1971	2575	—[3]	—[3]	[3]—	—[3]	979
1970	2727	—	—	—	—	1042
1969	2852	—	—	—	—	1164

1. Census defines as combination bending board
2. Census defines as combination nonbending board. These boards are used to produce rigid paperboxes, as well as for other uses.
3. Data not available

Source: Bureau of the Census

U.S. PRODUCTION OF RECYCLED PAPERBOARD GRADES

(000 short tons)

	Total	Liner-board	Corru-gating medium	Chip and filler boards
1981	2153	141	1326	280
1980	2070	518	1281	271
1979	2050	460	1301	290
1978	1981	332	1408	242
1977	1908	379	1286	243
1976	1470	227	1040	202
1975	1129	196	788	145
1974	1766	454	1114	198
1973	1741	295	1204	241
1972	1476	279	942	255
1971	1390	263	879	248
1970	1522	321	916	285
1969	1624	402	939	283

Source: Bureau of the Census

U.S. PRICE TRENDS FOR FOLDING BOXBOARD GRADES

($/short ton)

	20-pt clay-coated 80 bright (rolls)	20-pt chipboard bending (rolls)
1982		
2nd qrtr	425	280
Year-end		
1981	425	280
1980	400	275
1979	355	260
1978	305	225
1977	284	219
1976	262	212
1975	257	204
1974	*	196
1973		143
1972		116
1971		111

* Data not available

Source: P&P WEEK, P&P WEEK DATABOOK 1980

vatlined chip, filled news, and white vatlined chip. These grades can be pasted or laminated to form nonbending boards of greater thickness. Setup paperboard is overwrapped with specialty grades of paper for a more attractive box. Candy boxes are probably the most popular end-use for setup boxes, manufacturers indicate.

Setup paperboard is usually made from a lower grade of wastepaper than is used to make folding boxboard because setup boards are not subject to bending and scoring requirements of folding boxboard. Basis weights and calipers of setup paperboard range from as low as 15-pt (0.015-in.) to 65 pt (0.065-in.) board. A 15-pt board would have a basis weight of 60 lb/1000 ft^2 (293 g/m^2).

Setup paperboard capacity has decreased sharply over the last ten years, from about 540,000 tons in 1972 to about 380,000 tons in 1981. Nonetheless, producers of rigid boxes have not necessarily suffered since other paperboards, principally bleached boards, have replaced recycled setup paperboards in many end-uses. And in recent years production of recycled setup paperboard has tended to stabilize.

PAPERBOARD

Recycled paperboard grades—linerboard and corrugating medium—are made on fourdrinier or cylinder board machines.

Recycled linerboard, also called test linerboard, is normally made on a cylinder machine using old corrugated containers in the fiber furnish. Its burst or mullen requirements of 95 to 100 psi are equivalent to 42-lb linerboard made from virgin fiber. For test liner of greater strength a mill normally increases the weight of the sheet, such as making a 100-test recycled paperboard 48 to 50 lb/1000 ft^2 compared to 42-lb for virgin linerboard.

Production of test linerboard has remained on a relatively flat trend for years, with sharp cyclical fluctuations. Demand is strongest when the virgin linerboard market is tight but it can fall off sharply in a recession. The limitations on production of virgin linerboard are expected to increase the market for test linerboard later in the 1980s, however. (For a discussion of recycled corrugating medium, see section on Corrugating Medium.)

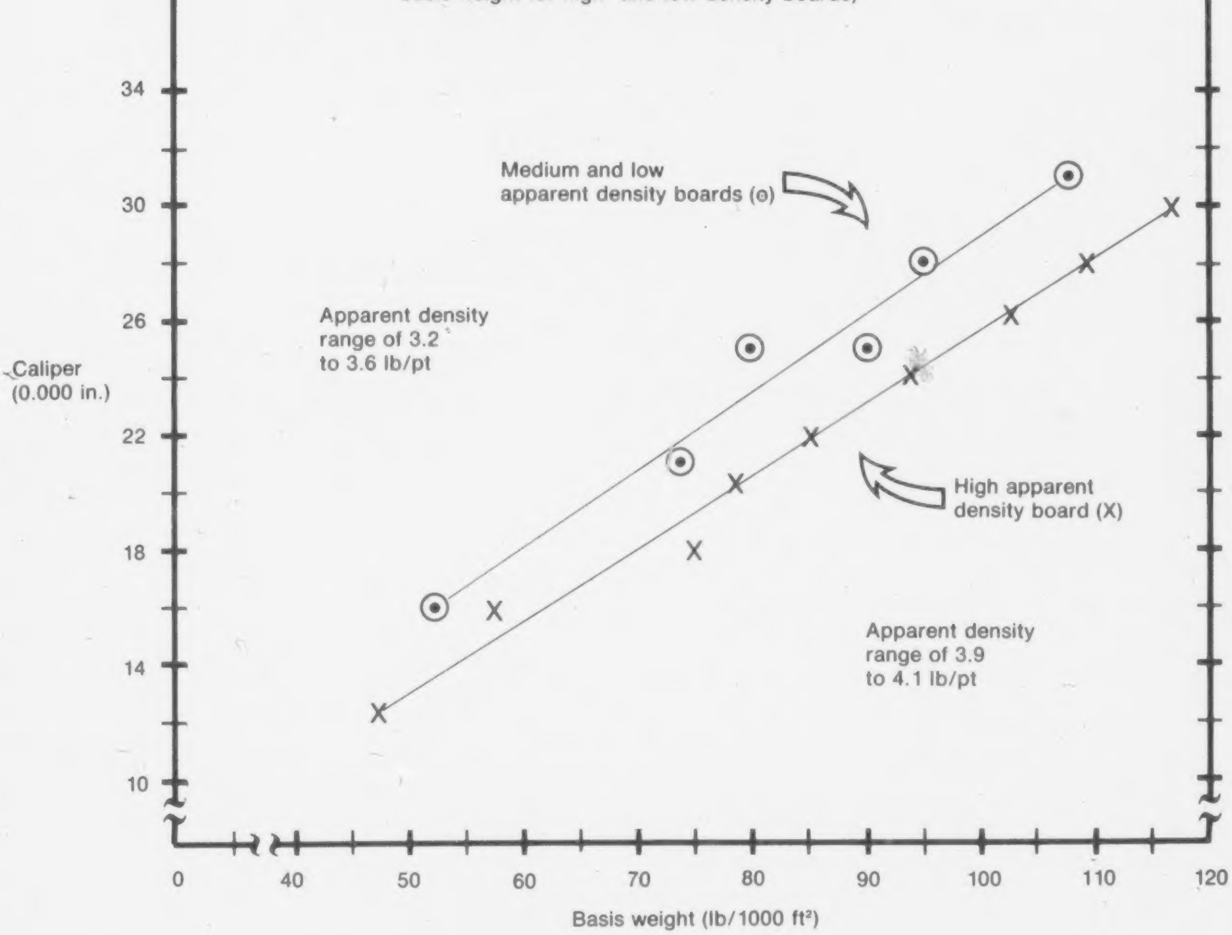
RECYCLED PACKAGING/INDUSTRIAL CONVERTING PAPERBOARDS

Gypsum linerboard, which is used on the front and back of a gypsum wallboard, is generally made by integrated producers of construction papers and boards. The major producers, which comprise 60% of total U.S. capacity, include U.S. Gypsum (325,000 tpy), National Gypsum (335,000 tpy), Georgia-Pacific (235,000 tpy) and Celotex Corp. (92,000 tpy).

The long-term outlook for gypsum linerboard is excellent because there are few competitive products

TYPICAL GRADE STRUCTURE FOR BOXBOARD GRADES

(approximate relation between caliper and basis weight for high- and low-density boards)



TYPICAL GRADE STRUCTURE FOR TEST LINERBOARD

Basis weight[1] (lb/1000ft²)	Caliper[1] (0.001-in.)	Mullen[1] (psi)
42	12	80-85
47	13	90
48/52	13/15	95/100
69	19	130

[1] Tests are approximate. These grades supplied in other weights and at different levels of mullen

with such a low price. In the short term, however, the market for gypsum wallboard can vary drastically from year to year depending on the housing industry, and thus affect demand for gypsum linerboard. In 1981 the gypsum wallboard market was down by about 20% from the previous year and in 1980 sales dropped about 20% from a good year in 1979, industry observers estimate. Housing starts were expected to improve later in 1982 with recovery continuing in 1983.

Core, drum, and tube stocks are produced by a number of recycled paperboard producers for use in fiber-based cans, tubes, and drums. This is a highly integrated industry and paperboard producers such as Sonoco Corp. operate core, drum, or tube converting facilities at their paperboard mills, or have converting plants located nearby. Converting plants and paperboard mills are located close to markets since the cost of shipping bulky cores, drums, or tubes for any distance is prohibitive.

Core, tube and drum stock producers were anticipating changes in market shares early in 1982 as Container Corp. of America and Owens-Illinois announced intentions to get out of the can business.

Basestocks for tube, core and drum stock are made in a variety of basis weights and strength ranges. For cores, the principal test is crush resistance. Typically, a kraft outer ply like a 13-pt (0.013-in.) virgin kraft wrapper, is used for core stock. The inner layers are made from semichemical furnish, high-yield kraft or recycled furnish. In most cases, recycled board is used, for example, 17-pt (0.017-in.) caliper core stock. When making tube or core stock, the parent rolls are cut into rolls about 5.0-in. wide. Standard cores have a 3-in. diameter and varying wall thicknesses; ⅜ and ½-in. wall thicknesses are common.

Production of unbleached kraft paperboard for tube, can, and drum stock is not included in the data for recycled paperboard. Census reports that around 200,000 tpy are used in this application (refer to introduction on Paperboard).

Panel and wallboard stocks are used to produce thick, rigid boards used for construction, automobiles, or trailers. The basestock is produced on cylinder board machines and then pasted or laminated together to make panel or wallboards of the different thicknesses. Wall and panelboard stocks are made by a limited number of producers (such as Upson Co. of Lockport, N.Y.; Haverhill Paperboard Corp. of Haverhill, Mass.; and Simplex Industries Inc. of Constantine, Mich.). The long-term market for these grades has been static, although demand tends to fluctuate with trailer production and new construction.

Other recycled paperboards include a wide range of specialty boards for printing and construction, as well as for a variety of specialty packaging uses such as railroad board, poster, mill bristols, and trailers. Specialty uses are expected to continue to experience their considerable growth trend of the last few years, with the many current producers increasing their own production.

FORMING METHODS

In the last two decades, recycled combination board grades have lost much of their competitive edge to fourdrinier board grades, especially to solid bleached sulfate (SBS) paperboard. SBS boards are produced from blends of virgin softwood and hardwood pulps, and secondary fiber is rarely used. With a fourdrinier, SBS boards can be produced at much higher production rates and somewhat lower density and MD/CD stiffness or grain ratio than recycled boards. The fourdrinier, however, is limited in the caliper range it can offer.

Solid bleached sulfate boards are usually produced in calipers ranging from 9 to 28 pt (0.009 to 0.028 in.), although they rarely exceed 20 pt (about 75 lb/1000 ft^2). Cylinder board machines normally produce boards in calipers ranging from 9 to 45 pt (0.009 to 0.045 in.), with most cylinder machines able to produce a wide range of combination paperboards, folding and setup boxboards, corrugating medium, gypsum linerboard, and chipboards.

Outside North America, a substantial amount of test linerboard is produced on multi-ply formers. The typical cylinder machine with an open stock-flow system and conventional cylinder mold and vat is limited in its performance. Due to centrifugal forces, it is difficult to operate a conventional cylinder board machine over 600 fpm. Such grades would have a tensile ratio of 4:1 (MD/CD), and no better than 3:1.

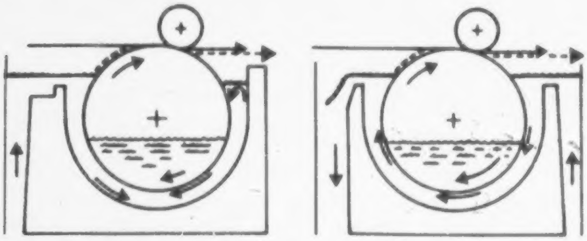
The conventional cylinder mold rotates opposite to the stock flow (counterflow vat). Stock is formed on a wire-covered cylinder mold by the pressure differential created by the difference in the stock level between the inside and outside of the cylinder mold. The sheet, or ply, is couched off the top of the cylinder by a felt and carried to another cylinder where it is joined to another ply. Counterflow systems produce a sheet with high fiber orientation in the machine direction. As speeds are increased, sheet formation becomes poorer; with signifiicant sheet variations, a decrease in weight pickup results.

Sheet formation can be improved somewhat by using a direct vat where cylinder mold rotation is in the same direction as stock flow. And additional improvement in formation can be achieved by use of a dry vat. The dry-vat principle, also called half vat, was developed by the Boxboard Research & Development Assn.

UPGRADING CYLINDER MACHINES

A number of approaches are offered for upgrading conventional cylinder formers. The easiest and least expensive way is to add new slice or headbox designs (pressure formers) to existing cylinder machines. This will give better control over grain ratios and better dewatering will result. Such units are speed-limited and rarely exceed 600 fpm, however. Units such as the Stevens Former (Beloit) and Sandy Hill's Rotoformer use vacuum suction to increase dewatering.

COUNTERFLOW VAT DIRECT-FLOW VAT



Source: PULP & PAPER, December 1978

TRADENAMES OF EACH MAJOR CLASS OF MULTI-PLY FORMERS

Company	Pressure formers	Suction formers	Cylinder on-top formers	Cylinder on-top formers with dewatering wire	Small flat forming zone with single wire	Twin-wire former
Beloit U.S./U.K.	Hydraulic		Bel-Vac			Inverform, Bel Bond
Cedeco Japan						Board Rotary Former
Dörries[1] W. Germany	see Voith	see Voith			Fourdri-Stairformer	
Escher Wyss W. Germany	Vat former	Suction Former	Top Former	Twintop Former I and II		
J. H. Horne U.S.	BRDA					DW Former
Kobayashi Japan			Ultra Former	Ultra C Former	Super Ultra Former	Ultra Twin Former
McGuckin & Pyle U.S.	BRDA					
Manchester U.S.	MF-350	MF-500	MF-1000/1200			
Maruishi Iron Works Japan	Up-Former					
Nippon Oil Japan						Aladdin Former
Sandy Hill U.S.	Adapta-Slice	Rotoformer, Hayes Former, RF Felt Former				
Tampella Finland	Pressure Former	Vacuum Former	On-Top Former	Arcu-Forma, Duplex Arcu-Forma		
Voith U.S./W. Germany	Semiformer	Suction Former			Duoformer K, Compact Wire S and F	

[1] O. Dörries GmbH is a subsidiary of Voith GmbH.

Source: PULP & PAPER, December 1978

In the late 1960s, Kobayashi introduced its first former, which it called the Ultra Former. This series of formers became known as cylinder-on-top-formers. In these the sheet is formed and dewatered on top of a cylinder mold or drilled shell and travels downward from the slice to be transferred to the top of a carrier felt of fabric.

The Kobayashi former was designed to replace individual vats on cylinder machines. The Ulta Former permits the felt pickup to wrap the cylinder mold, thus eliminating dropoff, a problem common to conventional cylinder vat machines. The Ultra Former also was able to produce a somewhat lower-density sheet than possible with conventional cylinder vats.

Another new former, the on-top cylinder former with dewatering wires, is designed to be used with fourdrinier formers but can be used in some cases in place of a conventional cylinder vat.

Multi-ply boards can also be produced on modified fourdrinier machines. Two approaches are as follows: (1) small fourdriniers are positioned on top of a long fourdrinier section, and (2) on-top formers are positioned on top of a fourdrinier section. Beloit has a different approach for making lightweight multi-ply on a fourdrinier by using a headbox (Strata-Flo/Converflo) which can simultaneously deliver a two- or three-ply sheet to a fourdrinier wire or twin-wire former.

Twin-wire formers made an early debut into multiply forming but were used only on a limited basis until the 1970s. The first twin-wire former was jointly developed by St. Anne's Board Mill in England and Walmsley (Beloit). It was called the Inverform and became the forerunner of all twin-wire formers. Inverform units were placed over a conventional fourdrinier table and considerable dewatering was achieved through the top wire via drainage in an upward direction.

By the 1970s, a number of machine manufacturers had developed their own versions of twin-wire formers. Based on its experience with the Inverform, Beloit developed its Bel Bond former. The Bel Bond has better dewatering and speed characteristics and like the Inverform units, can be positioned over a fourdrinier wire to form a multi-ply board.

Kobayashi's Ultra Twin Former, introduced in 1975, combines flat-forming and centrifugal water removal with a second fabric wire, but with the sheet formed before the meeting of the twin forming fabrics. The sheet is transferred to a felt where it is plied to the preceding layer carried by the felt.

U.S. AND CANADIAN CAPACITY FOR RECYCLED PAPERBOARD

(000 short tons)

	U.S. annual capacity Recycled paperboard grades					Canadian annual capacity Total boxboard excluding bleached board
	Total	Paper-board	Folding & and setup	Gypsum liner	Other[1]	
1983e	8901	2262	3051	1285	2304	918
1982e	8776	2218	3009	1269	2281	903
1981e	8593	2120	2959	1247	2268	887
1980	8617	2122	2942	1238	2313	890
1979	8757	2111	3019	1273	2355	949
1978	8642	2015	2986	1238	2403	938
1977	8699	2132	3117	1112	2337	833
1976	8774	2235	3155	1046	2337	782
1975	8717	2221	3123	1063	2310	785
1974	8680	2132	3170	1100	2278	714
1973	8330	1833	3182	1093	2221	681
1972	8185	1785	3109	1082	2209	659
1971	8078	1652	3292	1031	2104	—
1970	8084	1697	3381	1013	1993	—

1. Others include tube, can, and drum stock, special packaging boards, and panel and wallboard stocks

Sources: American Paper Institute and Canadian Pulp & Paper Assn.

ESTIMATED CAPACITIES FOR RECYCLED BOXBOARD/ PAPERBOARD OF MAJOR U.S. COMPANIES

	Annual capacity (000 short tons)	Grades*
1. Container Corp. of America (10)[1]	746	CB, BB, CM, LB, CS, TS, SP
2. Sonoco Products Co. (12)	555	PB, CS, DS, TS
3. National Gypsum Co. (5)[2]	392	GL, PB, CB, BB, CS, TS, SP
4. Whippany Paper Board Co. (2)[3]	378	BB, CM, LB, SP
5. St. Regis Paper Co. (3)	349	BB, CS, DS, TS, CB
6. U.S. Gypsum Co. (7)	347	GL
7. Packaging Corp. of America (5)	318	CB, BB, PB, CM, LB, GL
8. Caraustar Industries (5)[4]	309	BB, GL, PB, CS, TS, SP
9. Newark Boxboard Co. (7)	300	BB, CM
10. Federal Paper Board Co. (3)	283	CB, BB, PB
11. Mead Corp. (3)	265	BB, SP, CS, TS, PB
12. Alton Packaging Corp. (3)	251	CM, LB, BB, CS, TS
13. Rock-Tenn Co. (2)	210	CB, BB, GL, CS, SP
14. Crown Zellerbach (1)	200	CM, LB
15. Inland Container Corp. (2)	200	CM, LB
16. Diamond International Corp. (2)	175	CB, BB
17. Simkins Industries Inc. (2)	165	CB, BB, SP
18. James River Co. (1)	150	CB, BB
19. Georgia-Pacific Corp. (2)	141	GL
20. Durham Mills Inc. (1)[5]	135	LB, SP
21. Menominee Paper Co. (1)	120	LB, CM
22. Clevepak Corp. (2)	110	PB, GL, SP, TS
23. Menasha Corp. (1)	102	BB, PB, CS, DS, TS
24. Chesapeake Paperboard Co. (1)	85	PB, BB
25. Boise Cascade Corp. (3)	77	SP
26. California Paperboard Corp. (1)	73	PB, BB
27. Nabisco Inc.(1)	68	CB, BB
28. Cornwall Paper Mills Co. (1)	68	CM
29. Columbia Corp. (2)	65	BB, PB, SP
30. White Pigeon Paper Co. (1)	45	CB, BB
31. Newman & Co. Inc. (1)	44	BB, SP
32. Others	2051	

* Code: BB-uncoated boxboard; CB-coated boxboard; CM-corrugating medium; CS-core stock; DS-drum stock; GL-gypsum liner; LB-linerboard; PB-unspecified paperboards; SP-specialty paperboards; TS-tube stock.

[1] Number in parentheses is number of recycled paperbaord mills operated by a company

[2] Includes Gold Bond Building Products Div.

[3] Does not include the Durham, Pa., mill, which was sold in 1981. Whippany's other mills, which have been idle since July 1980, were sold in June.

[4] Holding company with ownership in Austell Box Board, Sweetwater Paper Board, Carolina Paper Board, and Carotell Paper Board

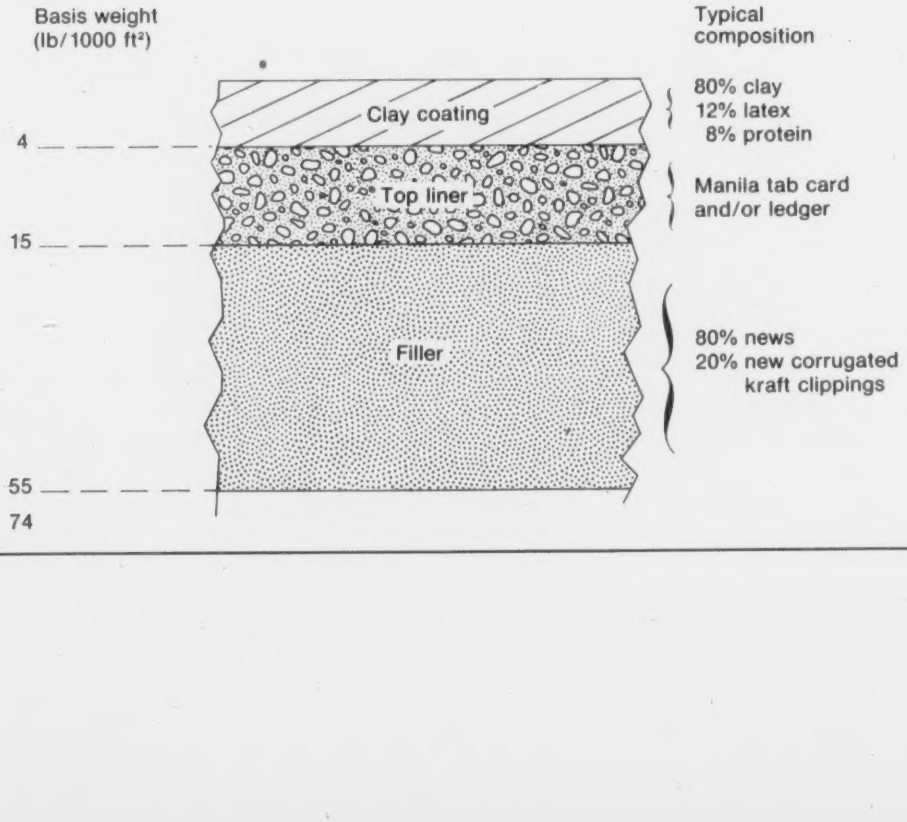
[5] Newly formed corporation which bought Whippany's Durham, Pa., mill

ESTIMATED CAPACITIES FOR RECYCLED BOXBOARD/ PAPERBOARD OF CANADIAN COMPANIES

	Annual capacity[1] (000 short tons)	Grades[2]
1. Belkin Paperboard (3)[3]	390	CB, PB, CM, LB, GL, CS
2. Georgia-Pacific Corp. (1)	100	BB, PB, TS, GL
3. Trent Valley Paperboard Mills (1)	100	BB, CS, PB, TS, SP
4. Atlantic Packaging Products Ltd. (1)	100	CM, LB
5. Kruger Pulp & Paper Ltd.(1)	90	LB, CS, TS
6. Sonoco Ltd. (2)	58	PB, CS, TS, DS
7. Strathcona Paper Co. (1)	45	BB, PB, SB, CB
8. Minas Basin Pulp & Paper Co. (1)	30	BB, PB, CS, LB, TS, PB
9. Others	79	

1. Does not include solid bleached folding boxboard grades
2. Code: BB-uncoated boxboard; CB-coated boxboard; CM-corrugating medium; CS-core stock; DS-drum stock; GL-gypsum liner; LB-linerboard; PB-unspecified paperboard; SP-specialty paperboard; TS-tube stock
3. Number in parentheses is number of recycled paperboard mills operated by a company.

COMPOSITION OF 18-POINT CLAY-COATED FOLDING BOXBOARD


Basis weight (lb/1000 ft²)
Typical composition
Clay coating
80% clay
12% latex
8% protein
4
Top liner
Manila tab card and/or ledger
15
Filler
80% news
20% new corrugated kraft clippings
55
74

U.S. EXPORTS AND IMPORTS OF RECYCLED PAPERBOARD

(000 short tons)

	Exports[1]	Imports[2]
1981	174	40
1980	249	57
1979	176	42
1978	203	47
1977	268	28
1976	306	13
1975	262	8
1974	283	34
1973	207	33
1972	163	8
1971	168	17
1970	151	10
1969	143	11

1. Census data for total recycled-furnish paperboard
2. Census data for test containerboard and other paperboard

CANADIAN PRODUCTION OF BOXBOARD GRADES

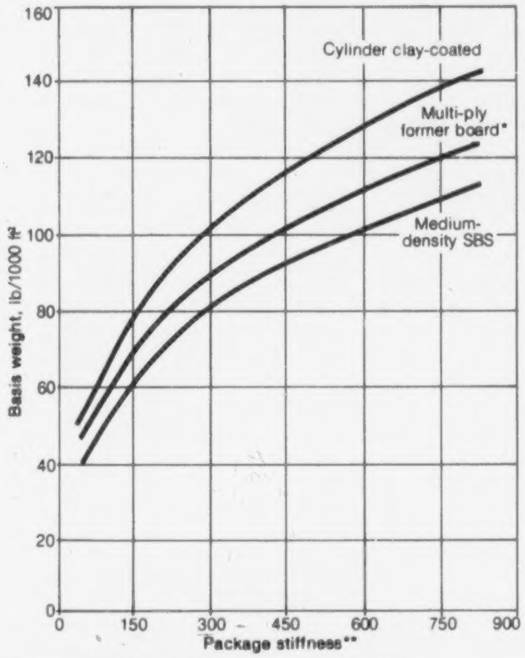
(000 short tons)

	Folding[1]	Non-folding	Other	Total
1981	—	—	—	773
1980	424[2]	110	261	795
1979	455[2]	136	291	882
1978	400[2]	188	276	699
1977	368[2]	146	239	612
1976	356[2]	114	199	669
1975	297[2]	103	183	583
1974	259	165	367	791
1973	268	131	426	825
1972	277	120	245	642
1971	258	115	214	587
1970	250	111	233	594
1969	268	125	308	701

1. Excludes solid bleached board for years 1969 to 1974
2. Includes solid bleached board production estimated at approximately 110,000 tpy

COMPARISON OF PACKAGE STIFFNESS FOR GIVEN FIBER WEIGHT

(SBS board produced on fourdrinier machines, recycled fiber board made on conventional cylinder and on multi-ply formers)



*Assumes basic board density @ 3.5 lb/point/1000 ft²
coating weight @ 8 lb/1000 ft²
**Package stiffness = (MD stiffness)$^{0.33}$ X (CMD stiffness)$^{0.667}$
Source: Fibreboard Corp. and Arthur D. Little Inc.

Source: PULP & PAPER, December 1978

FOLDING CARTON INDUSTRY BOXBOARD GRADE TONNAGE MIX

	1981	1980	1970	1960
Total kraft	48.0%	50.4%	40.9%	19.9%
Solid bl sulfate	36.1	37.3	31.9	15.8
Solid unbl sulfate	11.9	13.1	9.0	4.1
Total recycled	52.0	49.6	59.1	80.1
Clay-coated news	38.8	35.6	29.7	12.9
Other recycled	13.2	14.0	29.4	67.2
Chip	n.a.	4.7	9.7	12.6
Bleached manila	n.a.	2.1	5.1	15.8
Patent ctd news	n.a.	2.0	9.2	29.8
Laminated	n.a.	3.5	3.9	7.0
Misc.	n.a.	1.7	1.5	2.0
Total kraft & recycled tonnage (000) short tons)	3274	3311	3075	2856

Source: Paperboard Packaging Council

U.S. PRODUCTION OF SPECIAL RECYCLED PACKAGING AND INDUSTRIAL CONVERTING PAPERBOARDS

(000 short tons)

	Total	Gypsum linerboard	Tube, can & drum stock	Panelboard wallboard stock	Others
1981	2383	—[1]	—[1]	—[1]	—[1]
1980	2262	1036	564	113	548
1979	2543	1210	628	137	568
1978	2453	1185	601	119	546
1977	2378	1099	680	113	485
1976	2205	963	701	86	454
1975	1913	821	630	67	395
1974	2228	960	733	67	467
1973	2403	1051	763	94	493
1972	2278	1053	728	117	380
1971	2048	936	641	105	366
1970	1739	807	573	90	270
1969	1771	847	527	113	285

[1] Data not available

Source: Bureau of the Census

WET MACHINE BOARD

GRADE STRUCTURE

Wet machine board products are produced from wet boards. The board is made on a single cylinder, or multi-ply machine, such as a Rotoformer. It is formed by building up layers of fiber that are picked up by a press and wound around a top roll. The board is then cut off the roll, and may be pressed, treated and dried. For higher grades such as binder board used for book covers, the board is supercalendered for more smoothness, density and stability.

Typical grades for wet machine-produced board are shown below:

A major portion of the furnish used to produce wet machine board is secondary fiber, including such grades as white and colored ledgers, computer printout, old news, and old corrugated containers.

WET MACHINE BOARD GRADES

Binder
Counter
Electrical insulating
Innersole
Pattern
Pressboard
Shoe
Shank
Suitcase
Template
Trunk

INDUSTRY STRUCTURE

Only a few companies produce wet machine board, and most make less than 10 tpd. U.S. capacity has varied considerably in the past few years from a high of 217,000 tons reached in 1975 to a low of 145,000 in 1978. After creeping up to 163,000 tpy in 1980, capacity is expected to remain around 161,000 tpy through 1984.

ESTIMATED ANNUAL CAPACITIES FOR WET MACHINE BOARD OF U.S. COMPANIES

(000 short tons)

1. The Davey Co.	86
2. Colonial Fiber Co.	30
3. Shryock Brothers Inc.	8
4. Spaulding Fibre Co.	7
5. Jenkins Products Corp.	6
6. Contoocook Valley Paper Co.	3
7. Milton Leather Board Co.*	3
8. Penacook Fibre Co.	3
9. Rogers Corp.	2.5
10. Stevens Paper Mills Inc.*	1.5

* Mills closed.

MARKETS

Demand for wet machine board appears to have suffered from increasing popularity of cheaper substitutes such as chipboard for binder board or plastic for luggage and trunks. A few years ago, plastics also threatened the binder market, but it appears that the market is still dominated by wet machine board.

Deterioration in markets during the recession of late

1981-82 reduced wet machine board mill operating rates to about 80%. Observers were uncertain if reduced demand was due to the economy or was an indication of long-term deterioration in markets, however.

Hard-covered book publishing is one area of uncertainty for the long-term future. The spread of video display terminals and the increasing popularity of paperback books could reduce the number of hard-covered books published and curtail the book binder market, one of the biggest consumers of wet machine board.

CAPACITY AND PRODUCTION OF WET MACHINE BOARD IN U.S.

(short tons)

Year	Capacity	Production
1984e	161,000	—
1983e	161,000	—
1982	161,000	—
1981	161,000	160,293
1980	163,000	137,649
1979	154,000	144,059
1978	145 000	136,000
1977	180,000	128,070
1976	216,000	129,955
1975	217,000	115,169
1974	188,000	143,862
1973	182,000	148,892
1972	181,000	147,914
1971	202,000	137,825
1970	166,000	139,055

e = estimated

Source: API and Bureau of the Census

CONSTRUCTION PAPER & BOARD

GRADE STRUCTURE

Construction papers and boards are generally unfinished goods that are eventually converted into finished building products. Grades are divided into the following three categories: (1) **insulating boards** of less than 31 lb/ft^3 apparent density, (2) **hardpressed boards** of greater apparent density than 31 lb/ft^3, and (3) **construction papers**.

Construction papers and boards are made from either mechanical pulps or wastepaper. The U.S. Dept. of Commerce reports that wastepaper makes up approximately half of fiber furnish used to produce construction papers and boards. The use of secondary fiber in the furnish is expected to continue to decline, however, and the use of fiberglass and plastic foam in making such products as roofing and insulation is expected to increase.

CONSTRUCTION PAPERS

Most **construction papers** are used to make roofing felts that are converted into asphalt roofing tiles. Construction papers are also used to a lesser extent in automobiles, flooring and sheathing. Woodflour and sawdust are generally blended with wastepaper or fiberglass in making roofing. This increases the porosity of the sheet, enabling it to absorb asphalt more readily when maufacturing asphalt tiles.

Fiberglass tiles have become more popular in recent years, reducing the amount of wastepaper used in making roofing. The two principal basis weights of roofing produced are 28- and 55-lb sheets (480 ft^2 basis).

Fiberglass uses about 30% less asphalt than paper-based felt because fiberglass does not have not have to be impregnated with asphalt before asphalt coating takes place, whereas organic felt must go through both stages of asphalt treatment. Fiberglass has a high fire-resistance rating—an "A" compared with " C" for paper-based felt—and also has a longer life span than organic felt.

Roofing felt is usually made on a cylinder board machine, mainly with a single-vat former. Fourdriniers are used to produce wet-laid glass mat, however. They have an inclined wire to allow for the heavy drainage requirements of fiberglass. Most glass mat is made by a wet process, although manufacturers such as Certain-Teed and reportedly Owens Corning Fiberglas make some mat from a dry process. Of the 11 machines of

U.S. STATISTICS: CONSTRUCTION PAPERS

	1982e	1981	1980
Production, 000 tons[1]	1000	1150	1369
Capacity, 000 tons	2243	2272	2345
Imports, 000 tons	135	140	148
Exports, 000 tons	15	17	23
Apparent U.S. consumption 000 tons	1120	1273	1494
CONSTRUCTION BOARDS[2]			
Production, 000 tons[1]	2400	2706	3020
Capacity, 000 tons	4349	4382	4389
Imports, 000 tons	242	231	210
Exports, 000 tons	160	108	55
Apparent U.S. consumption 000 tons	2502	2829	3175

1. All tons are short tons
2. Includes insulating and hardpressed boards; does not include wet machine boards
e = estimated

this type installed so far, the majority are in the 60- to 80-tpd class, 117- to 156-in. wide, producing a mat consisting of 80% fiberglass and 20% binder. Sandy Hill Corp. and Voith Inc. are the major suppliers.

BUILDING BOARDS

Insulation board and **hardboard** are the two subcategories of building boards. They are wood-based fiber panel materials, and are also referred to as building fiberboards. Insulation board is considered a product of the paper industry while hardboard, like panelboard, is made by solid wood manufacturers.

Insulation board is made on fourdrinier paper machines from defibrated woodpulp or from bagasse. Rarely is wastepaper used. Hardboard, which is also called hardpressed board, is made under a different manufacturing process that involves using pressure and heat to consolidate the fibers. Hardboards are generally classified into three degrees of density (referred to in table on properties of wood-based building fiberboards).

Insulation boards are less dense than building boards (below 31 lb/ft^3). They are made in a number of thicknesses, such as ½-in., and production is usually reported on an area basis rather than a weight basis. Insulation boards are divided into two classifications—semirigid and rigid.

Semirigid insulation boards are more pliable than rigid insulation boards, but are able to keep their shape when bent, fastened, cemented, or framed. They are used for sound insulation in telephone booths and stereo speakers; in cushioning for furniture and packaging; and in heat insulation for vehicles, railcars, refrigerators, and ductwork.

Rigid insulation boards are divided into two categories—interior and sheathing. The difference is that **sheathing boards** are made water-resistant with the use of resins or asphalt, while **interior boards** are not water-resistant.

These two basic types are made into a number of special products suitable for specific construction uses and for a number of packaging and other nonconstruction applications. Specific structural insulating board products are (1) building board, (2) wallboard, (3) insulating deck board, (4) above-deck thermal insulating board, (5) ceiling tile and lay-in panels, (6) planking, (7) sheathing, and (8) shingle backing.

Hardpressed boards are either of medium density or high density. Among the wide variety of uses for hardpressed boards are applications in making furniture, appliances, automobiles, railcars, store fixtures, and in general construction work. **Medium-density boards**, which range in density from 40-48 lb/ft^3, are used mostly in furniture and home siding. **High-density boards** range in density from 50 to 65 lb/ft^3.

Defibrated woodpulp is formed into a sheet by a wet or dry forming process to make hardboard. Of the 22 hardboard plants operating in the U.S. currently, ten use dry-forming techniques. The panels are cut to size,

U.S. PRODUCTION OF CONSTRUCTION PAPERS AND BOARDS

(000 short tons)

	Construction papers	Insulating boards	Hardpressed boards
1981	1150	846	1858
1980	1369	1051	1970
1979	1868	1263	2306
1978	1915	1416	2294
1977	1851	1403	2237
1976	1771	1434	2110
1975	1616	1249	1784
1974	1845	1295	1978
1973	1858	1547	2001
1972	1915	1529	1908
1971	1837	1446	1718
1970	1594	1219	1463
1969	1603	1352	1421

Source: Bureau of the Census

U.S. CAPACITY FOR CONSTRUCTION PAPERS AND BOARDS

(000 short tons)

	Construction papers	Insulation boards	Hardpressed boards
1983	2238	1799	—
1982	2243	1799	—
1981	2272	1832	—
1980	2345	1839	2550e
1979	2380	1885	2556e
1978	2352	1830	2525e
1976	2317	1832	2511
1974	2165	1898	2334
1972	2076	—	—
1970	2042	—	—

e = estimated

Source: American Paper Institute

PROPERTIES OF WOOD-BASE BUILDING FIBERBOARDS[1]

Property	Unit	Structural insulating board	Medium-density fiberboard	High-density hardboard	Tempered hardboard	Special densified hardboard
Density	lb/ft³	10-30	33-50	50-65	60-80	85-90
Specific gravity	1000 psi	0.16-0.42	0.53-0.80	0.80-1.28	0.93-1.28	1.36-1.44
Modulus of elasticity (bending)	psi	25-125	325-700	400-800	650-1,100	1,250
Modulus of rupture	psi	200-800	1,900-6,000	3,000-7,000	5,600-10,000	10,000-12,500
Tensile strength parallel to surface	psi	200-500	1,000-4,000	3,000-6,000	3,600-7,800	7,800
Tensile strength perpendicular to surface	psi	10-25	40-200	75-400	160-450	500
Compressive strength parallel to surface	psi	—	1,000-3,500	1,800-6,000	3,700-6,000	26,500
Shear strength (in plane of board)	psi	—	100-475	300-600	430-850	—
Shear strength (across plane of board)	psi	—	600-2,500	2,000-3,000	2,800-3,400	—
24-hour water absorption	% volume	1-10	—	—	—	—
24-hour water absorption	% weight	—	5-20	3-30	3-20	0.3-1.2
Thickness swelling, 24-hour soaking	%	—	2-10	10-25	8-15	—
Linear expansion from 50 to 90% relative humidity[2]	%	0.2-0.5	0.2-0.4	0.15-0.45	0.15-0.45	—
Thermal conductivity at mean temperature of 75°F	Btu in./h ft²/°F	0.27-0.45	0.54-0.75	0.75-1.40	0.75-1.50	1.85

1. Data shown are general round-figure values from numerous sources; for more exact figures on a specific product, individual manufacturers should be consulted. Values are for general laboratory conditions of temperature and humidity
2. Measurements made on material at equilibrium at each condition at room temperature

Source: Wood handbook, Forest Products Laboratory, U.S. Department of Agriculture, No. 72, 1974 treated with chemicals and then high pressure is applied to the board. It is dried later if necessary. Production of hardboard is usually reported by area (square foot) at ⅛-in. thickness. Square footage production of medium-density fiberboard is generally reported in a ¾-in. thickness.

OUTLOOK

Demand for construction grades, which relies heavily on construction activity, particularly residential housing, has been severely affected by the sharp decline in new housing starts since 1979. Housing starts in 1981 plunged to 1.1 million units, their lowest level since 1946, with most forecasts for 1982 at just over 1 million units.

The recovery in housing was expected to get off to a modest start in late 1982 and to accelerate through 1983, with an estimated 1.3 million units being built that year. But analysts say housing starts for the rest of the decade will remain considerably lower than the 2-million start peak reached in the late 1970s. A survey published by Morgan Guaranty Trust Co. in May 1982 indicates housing starts will average 1.4 to 1.5 million a year for the 1982-86 period.

Interest rates are the single most important factor in determining the level of housing starts and expectations were that mortgage rates might decline slightly in the latter half of 1982. But even if borrowing becomes more affordable, the construction market will probably not be as robust during the 1980s as in the previous decade due to a trend toward smaller houses and reduced government spending for various types of projects, industry observers say.

Within the construction paper/board market, sales of roofing felt and insulation board should continue to be eroded by increasing popularity of fiberglass and rubber roofing products and fiberglass and foam insulating materials.

Roofing felt remained the most popular roofing material in 1981, but fiberglass mat made considerable headway in expanding its share of the market in 1980 and 1981. In 1981, fiberglass captured more than 20% of the total roofing market compared with 11% in 1980 and 9.4% in 1979, according to the Dept. of Commerce. By 1984-85, the government estimates 60% of all roofing will be fiberglass-based.

The fiberglass share of the shingle market segment reached an estimated 40% in 1981, and was expected to expand to 50% in 1982. An industry marketing executive indicated that by 1988, fiberglass will have 70% to 75% of the residential segment of the market and 40% to 50% of the commercial business.

In the past few years, a number of roofing producers have converted all or a great percent of their capacity to fiberglass mat from organic-based roofing products. In 1981, an estimated 165,000 tpy in fourdrinier and another 60,000 of dry-process glass mat capacity was added. Observers estimate that an additional 20,000- to

U.S. INDUSTRY STATISTICS FOR CONSTRUCTION PAPER AND INSULATING BOARDS[1]

	Value of shipments[2] (million $)	Employees (000)	New capital expenditures (million $)
1980[1]	517.8	—[3]	—[3]
1979[1]	563.6	6.9	—[3]
1978[1]	564.4	7.1	—[3]
1977[1]	514.3	7.0	16.2
1976	428.7	7.6	12.1
1975	486.9	9.4	26.2
1974	546.7	11.1	62.6
1973	488.9	11.3	26.4
1972[1]	456.2	11.6	18.8
1971	465.7	12.2	18.2
1970	396.8	11.8	17.6

1. Data from Census of Manufactures. All other years estimated.
2. Does not include data for hardpressed boards and only includes the value of shipments of the products classified in this industry classification. Total value of shipments for construction papers would be slightly higher
3. Not available

CONSTRUCTION PAPERS AND BOARDS U.S. PRICES—TRENDS

($/1000 ft^2, year-end)[1]

	Insulation board (1/2-in.)	Hardboard (Type 11, 1/8-in.)
1981	$86.90	$133.83
1980	81.14	119.99
1979	62.09	101.76
1978	78.98	97.25
1977	70.15	89.043
1976	58.54	82.993
1975	49.98	71.177
1974	51.67	64.566
1973	49.09	65.023
1972	45.63	61.489
1971	42.63	65.099
1970	39.67	67.730

1. Average

Source: Bureau of Labor Statistics, quoted by P&P WEEK DATABOOK 1980

CANADIAN PRODUCTION AND CAPACITY: BUILDING PAPERS AND BOARDS

(000 short tons)

	Production		Capacity
	Building[1] papers	Building[2] boards	Building papers/ boards
1983	—	—	821
1982	—	—	805
1981	—	—	805
1980	140	333	827
1979	152	377	858
1978	163	443	842
1977	157	336	796
1976	164	410	792
1975	161	374	795
1974	157	468	794
1973	163	497	776
1972	172	463	725
1971	146	427	—
1970	102	371	—

1. Canadian classification for building papers do not necessarily represent actual production. For example, exports for building papers exceed production
2. Includes both insulation and hardpressed boards. For 1980, CPPA reports 277,000 tpy capacity for "building boards, soft" and 293,000 tpy for "building boards, hard"

Source: Canadian Pulp & Paper Assn.

MARKET INDICATORS FOR CONSTRUCTION PAPERS AND BOARDS

	Consumption[1] (000 short tons)	Value of new construction[2] (constant 1972 $ million)	New housing starts (000 units)
1981	3848	99,900	1084
1980	4390	103,000	1292
1979	5436	114,900	1749
1978	6090	117,358	2023
1977	5759	111,178	1990
1976	5450	104,995	1548
1975	4710	97,229	1171
1974	5331	109,132	1352
1973	5760	126,924	2057
1972	5734	123,920	2379
1971	5228	116,037	2085
1970	4418	107,009	1469
1965	4122	109,678	1510
1960	3266	62,568	1296

1. Includes construction papers, insulation and hardpressed boards
2. New construction put in place

30,000-tpy would be added by the end of 1982. Additional fiberglass capacity coming on-line in the next few years is expected to keep operating rates at about 70%.

Since 1980, a number of producers have also come out with new single-ply, rubber roofing systems which some analysts expect will dominate the commercial building market in a few years. In 1982 GAF entered the single-ply roofing market with an ethylene-propylene-diene monomer system.

Production of insulation board decreased from 3.8 billion ft^2 (½-in. basis) in 1971 to 2.5 billion in 1980 and some observers estimate that production in 1982 was below 2 billion ft^2—with the industry running below 50% of capacity and some mills permanently shutting down. The reason for this gloomy picture was not only the housing depression but also competition from plastic foamboard. Foamboard has a core of polyisocyanurate surfaced on both sides with aluminum foil. About 28 foamboard plants are now operating in the U.S. with a total estimated annual capacity close to 4 billion ft^2 (½-in. basis)—or more than enough to replace the entire current production of insulating board in this country.

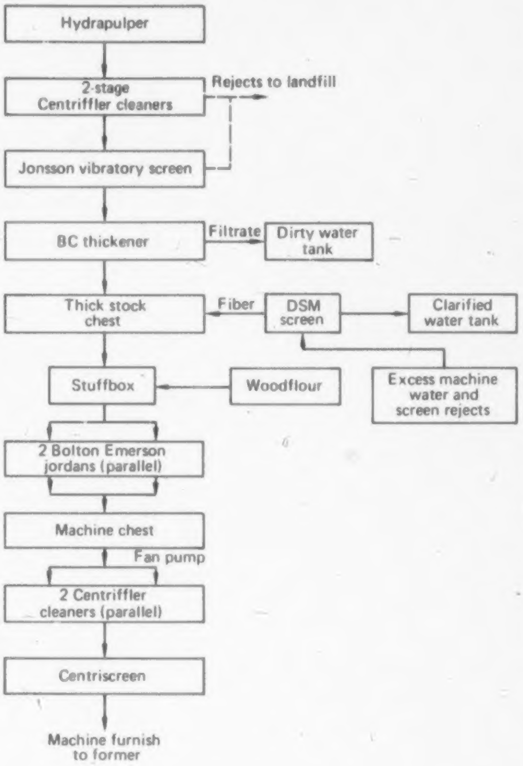
The main advantage of foamboard is a higher R-value (thermal resistance) than insulation board. A typical R-value for ½-in. foamboard is 3.6 vs 1.5 for insulating board of the same thickness. Since building authorities in the U.S. recommend a minimum R-value of 11 for side walls, which is usually obtained by using fiberglass insulation in addition to sheathing and sheetrock, the use of foamboard in lieu of insulation board would permit the use of a thinner lay of fiberglass insulation.

As long as the price ratio for foamboard to insulation board (3:2 at present for ½-in. board) does not increase, the production of insulating board in the U.S. is expected to continue to decrease.

Production of hardboard in the U.S. has increased slowly during the last decade, from 5.1 billion ft^2 (⅛-in. basis) in 1971 to 5.9 billion in 1980. Imports of hardboard have tapered off from 1 billion ft^2 (⅛-in. basis) in 1973 to about a half billion in 1980, equivalent to about 10% of domestic production. The downturn in housing has affected the hardboard industry, with an American Hardboard Assn. official estimating average capacity utilization in early 1982 at about 60%. Siding is becoming the most important product of the hardboard industry and now accounts for 50% to 60% of total hardboard industry output. Hardboard appears to be a fairly mature construction material and no new plants have been built in the U.S. during the last decade.

First production of medium-density fiberboard began in 1966 and by 1978 production in the U.S. reached a record 539 million ft^2 before dropping to 513 billion ft^2 in 1980 (¾-in. basis), according to National Particleboard Assn. data. By 1980, MDF production amounted to nearly 17% of particleboard output, an older building material over which MDF has a number of advantages.

PROCESS FLOWSHEET FOR THE PRODUCTION OF ROOFING FELT


Hydrapulper
2-stage Centriffler cleaners
Rejects to landfill
Jonsson vibratory screen
BC thickener
Filtrate
Dirty water tank
Thick stock chest
Fiber
DSM screen
Clarified water tank
Stuffbox
Woodflour
Excess machine water and screen rejects
2 Bolton Emerson jordans (parallel)
Machine chest
Fan pump
2 Centriffler cleaners (parallel)
Centriscreen
Machine furnish to former

Source: PULP & PAPER, May 1975

ESTIMATED ANNUAL CAPACITIES OF INSULATION BOARD COMPANIES

(000 short tons)

	U.S.	Canada	Total
1. Celotex Corp.	365	—	365
2. Boise Cascade Corp.	154	—	154
3. U.S. Gypsum Co.	130	50	180
4. National Gypsum	119	—	119
5. Conwed Corp.	95	—	95
6. Manville Corp.	95	—	95
7. Owens-Corning Fiberglas	81	—	81
8. Building Products of Canada	—	65	65
9. Masonite Canada Inc.	—	29	29
10. Temple Eastex Inc.	16	—	16
11. Others	744	91	835
TOTAL	1799	235	2034

* PULP & PAPER estimate

ESTIMATED ANNUAL CAPACITIES OF HARDPRESSED BOARD COMPANIES

(000 short tons)

	U.S.	Canada	Total
1. Masonite Corp	1001	—	1001
2. Abitibi-Price Inc.	371	—	371
3. Celotex Corp.	224	—	224
4. Superwood Corp.	197	—	197
5. Champion International	146	—	146
6. Georgia-Pacific Corp.	145	—	145
7. Weyerhaeuser Co.	139	—	139
8. U.S. Gypsum Co.	100	—	100
9. Temple Eastex Inc.	87	—	87
10. Louisiana-Pacific Corp.	56	—	56
11. MacMillan Bloedel	—	15	15
12. Masonite Canada Inc.	—	2	2
13. Others	171	243	414
TOTAL	2550*	260*	2810

* Pulp & Paper estimate

ESTIMATED ANNUAL CAPACITIES FOR PRODUCERS OF CONSTRUCTION PAPERS

(000 short tons)

	U.S.	Canada	Total
1. GAF Corp.	166	—	166
2. Celotex Corp.	281	—	281
3. Genstar Building Materials	190	—	190
4. Tamko Asphalt Products	137	—	137
5. Manville Corp.	123	—	123
6. Certain-Teed Corp.	120	—	120
7. Building Products of Canada	—	115	115
8. Owens-Corning Fiberglas	54	—	54
9. IKO Industries Ltd.	—	54	54
10. Georgia-Pacific Corp.	45	—	45
11. Others	1127	81	1208
TOTAL	2243	250*	2493

* PULP & PAPER estimate

MDF can be machine-edged, embossed, engraved and contoured and is also more profitable to make, since it sells at a premium of $100 to $125/1000 ft^2 (¾-in board) over the price of particleboard for the same use even though made from a cheaper raw material (mixed hardwoods).

MDF has been doing better than other types of fiberboard through the recent recession, with the 1980 operating rate for the 11 MDF plant in the U.S. averaging 80%. This is because the main market for MDF is furniture rather than the depressed home building market. Although the decline in new home production in the U.S. is likely to eventually affect demand for furniture, MDF will probably continue to grow because of its role as a particleboard replacement. Although no new plants have been built in the U.S. since 1975, two are in the planning stage at Malvern, Ark., and Las Vegas, N.M.

WASTEPAPER USE

In the fiber furnish for construction papers and boards, the following proportions of wastepaper were used in 1980, according to the Dept. of Commerce: 772,000 tons (50.03%) mixed paper, 305,000 tons (19.77%) old news, 339,000 tons (25.86%) old corrugated container, 63,000 tons (4.08%) pulp substitutes, 5000 tons (0.32%) high-grade deinking.

According to the American Paper Institute capacity survey, the use of wastepaper in construction paper and board is expected to rise modestly from 1.56 million tons in 1981 to 1.64 million tons in 1982 and 1.66 million tons in 1983 and then to decline slightly to 1.65 million tons in 1984.

In addition to its use in construction paper and board, wastepaper is also used directly, in loose form, as an insulating material. Such cellulose insulation is generally made from shredded waste newspapers, chemically treated with boric acid. Cellulose insulation held an estimated 10% market share in 1981 and fiberglass sales represented about 50% of the market, according to one observer. Both markets were expected to gain some from a government ban on urea formaldehyde insulation early in 1982, but fiberglass was expected to absorb most of that market share. Fiberglass is considered to be more fire-resistant and a better insulating material than cellulose.

According to the Insulation Institute, in 1981 there were just 235 insulation producers left of 900 that sprang into business during the 1977-78 boom period in home insulation. Cellulose insulation producers, however, have been stepping up product innovations to make them more competitive. In recent years they have developed a way to blow cellulosic insulation into walls, enabling them to compete for that market in insulating older homes. Foam insulation is the most popular product used in the reinsulation market now. Fiberglass insulation, which can only be laid into open walls, is mainly used in the new construction market.

ESTIMATED MATERIALS USED IN MANUFACTURE OF CONSTRUCTION PAPER AND INSULATION BOARDS

(Does not include hardpressed boards)

	1977	1972
Shipments, total, 000 tons[1]	2569.0	2988.6
Pulpwood, 000 cords, 128 ft^3	1022	1069
Softwood, bolts, logs	188	285
Chips	538	418
Slabs, and other wastes	97.6	92.7
Hardwood, bolts, logs	94.3	140.1
Chips, slabs, etc.	104.4	132.9
Chemical		
Caustic soda, 100% NaOH, 000 tons[1]	1.7	—[2]
Titanium dioxide, million lb	2.0	6.9
Aluminum sulfate, 000 tons	7.6	—[2]
Lime, 000 tons	1.8	—[2]
Fiber		
Woodpulp produced & consumed at site, 000 tons[1]	1254.8	—[3]
Purchased woodpulp, 000 tons[1]	3.2	—[3]
Wastepaper, 000 tons[1]	779.0	819.3
Mixed	447.9	489.6
News	117.6	181.5
Corrugated	213.5	148.2
Other materials		
Fiber, rags, straw, etc., 000 tons[1]	—[2]	345.0
Asbestos, 000 tons	125	130.7
Kaolin and clay, million lb	24.7	32.1
Starch, million lb.	52.9	73.4

1. All tons are short tons
2. Data not collected
3. Withheld to avoid disclosure of operations from individual companies

Source: 1977 Census of Manufactures

MARKET PULP

Market pulp is defined as woodpulp produced for sale in open competition with pulp from other producers. It excludes tonnage intended for consumption in the producing mill or for shipment to any mill in Canada or the U.S. which is owned by, controlled by or affiliated with the producing mill.

There are two basic types of market pulps: (1) dissolving or special alpha pulps and (2) paper-grade pulps. The paper-grade pulps can be divided into four grades: (1) bleached sulfite, (2) bleached and semibleached sulfate, (3) unbleached sulfate, and (4) mechanical pulps. Also, specialty market pulps are produced for nonpaper uses, principally for fluff pulp applications and molded pulp products.

Most paper-grade market pulp is cut into sheets and sold in bale form but some is sold in rolls and a small amount is flash-dried and baled.

Pulp mills producing dissolving pulp are specially designed to produce high-quality chemical cellulose. If dissolving pulp demand is limited, these mills can also produce paper-grade pulps. Also, mills producing captive, paper-grade pulps can sell this pulp on the open market if internal pulp demands are low. In turn, if internal pulp demands are high, market pulp mills may shift tonnage to affiliated mills. Consequently, capacity ratings for paper-grade market pulp tend to be inexact.

NORTH AMERICAN INDUSTRY STRUCTURE

The U.S. pulp and paper industry is highly integrated and market woodpulp production accounts for only a small percentage of total woodpulp production or consumption.

In 1981, the U.S. produced almost 46 million metric tons of paper-grade woodpulp, of which 86% was consumed on site, 5% was shipped to affiliated mills in the U.S., 4% was shipped to the domestic market and 5% was exported. Apparent U.S. paper-grade woodpulp consumption in 1981 amounted to slightly more than 47 million metric tons, of which 84% was shipped from integrated sources within the U.S., 5% was derived from U.S. affiliates, 4% came from the domestic market and 7% from imports—including "tied" shipments from Canada.

Thus, the U.S. is a net importer of paper-grade woodpulp, with consumption about 1.2 million metric tons higher than domestic production.

Paper-grade market pulp is principally used in three paper grades in the U.S.: (1) uncoated free-sheet; (2) coating printing and publication grades; and tissue. The remainder is used in packaging and industrial converting grades, bristols and bleached board. Nonintegrated capacity at smaller, older paper mills located principally in the Northeast has been declining and future shipment growth for both U.S. and Canadian market pulp producers is expected to mainly be in export markets.

STATISTICS FOR MARKET PULP

	1980	1981	1982e
UNITED STATES			
Production, 000 tons*	4457	4402	4190
Annual capacity, 000 tons	4653	4897	4943
Utilization rate, %	95.8	89.9	84.8
Apparent consumption, 000 tons	4547	4474	4000
Imports, 000 tons	2438	2390	2060
Exports, 000 tons	2348	2318	2250
CANADA			
Production, 000 tons	6605	6080	5000
Annual capacity, 000 tons	6690	6010	6010
Utilization rate, %	98.7	89.3	73.4

* Market pulp reported in metric tons (metric tons = 2205 lb or 1.1023 short tons).

U.S. MARKET PULP MILLS—SUMMARY OF STATISTICS

Year[1]	All establishments Total (number	All establishments With 20+ employees (number)	Employees Number (000)	Employees Payroll (million $)	Value added by manufacture (million $)	Cost of materials (million $)	Value of shipments (million $)	New capital expenditures (million$)
1980 ASM	n.a.	n.a.	16.2	404.6	1292.7	1776.9	3031.9	258.8
1979 ASM	n.a.	n.a.	15.7	338.9	1117.2	1417.2	2544.1	239.7
1978 ASM	n.a.	n.a.	15.1	306.3	855.5	1268.0	2,152.4	194.6
1977 Census	45	42	16.2	293.2	885.7	1212.4	2071.1	301.1
1976 ASM	n.a.	n.a.	15.7	260.5	974.6	1087.7	2055.4	375.0
1975 ASM	n.a.	n.a.	13.1	191.4	821.0	837.0	1630.4	294.2
1974 ASM	n.a.	n.a.	12.0	163.2	779.3	766.1	1525.2	135.6
1973 ASM	n.a.	n.a.	10.8	138.2	382.7	464.0	848.5	118.7
1972 Census	60	35	10.6	125.7	306.9	388.1	709.9	136.4
1971 ASM	n.a.	n.a.	14.5	156.3	367.2	496.4	841.8	135.2
1970 ASM	n.a.	n.a.	15.6	160.2	466.3	508.3	960.3	121.6
1969 ASM	n.a.	n.a.	14.9	142.6	362.0	455.2	820.0	132.6
1968 ASM	n.a.	n.a.	15.4	136.0	361.3	431.2	799.3	77.0
1967 Census	61	43	15.1	125.6	333.7	403.2	730.5	121.8
1966 ASM	n.a.	n.a.	14.8	112.3	346.1	320.1	658.5	113.3
1965 ASM	n.a.	n.a.	14.8	112.3	346.1	320.1	758.5	112.2
1964 ASM	n.a.	n.a.	15.3	113.6	331.6	328.6	662.8	66.6
1963 Census	45	40	15.1	107.4	295.8	312.6	609.1	38.9

[1] In years of Annual Survey of Manufactures (ASM), data are estimates based on a representative sample of establishments canvassed annually and may differ from results of a complete canvass of all establishments

Source: 1977 Census of Manufactures

NORTH AMERICAN AND SCANDINAVIAN PRODUCER INVENTORIES OF CHEMICAL PAPER-GRADE MARKET PULP

(000 metric tons)

	1982	1981	1980	1979	1978	1977	1976	1975	1974
January	1585	1097	745	938	2119	2891	2121	860	628
February	1692	1194	741	1006	2016	2920	2260	1016	628
March	1772	1209	747	960	1857	2888	2373	1326	625
April	1743	1193	754	865	1776	2760	2408	1465	595
May	1835	1185	801	809	1612	2810	2474	1754	565
June		1026	745	737	1288	2789	2588	1858	532
July		1116	813	759	1188	2822	2638	1980	545
August		1195	916	790	1193	2865	2749	2101	557
September		1146	830	734	1069	2776	2720	2049	538
October		1373	933	713	1046	2656	2809	2091	550
November		1573	1094	723	1038	2577	2882	2163	567
December		1430	949	616	903	2083	2824	2013	611

U.S. MARKET WOODPULP CAPACITY

(000 short tons)

Year	Total all grades	Dissolving	Total paper grades	Bleached sulfate	Unbleached sulfate	Sulfite	Others
1984e	7029	1563	5456	5004	146	305	10
1983e	7110	1563	5537	5086	146	305	10
1982e	7022	1563	5449	4990	153	305	17
1981	6978	1563	5398	4860	175	363	96
1980	6801	1576	5129	4589	172	369	103
1979	6344	1551	4682	4228	104	350	101
1978	5746	1573	4069	3653	107	309	104
1977	5467	1611	3856	3280	164	301	111
1976	5407	1421	3986	3194	218	459	116
1975	5412	1488	3924	3218	212	460	34
1974	5557	1636	3921	3240	191	471	19
1973	5365	1590	3775	3102	148	505	20
1972	5412	1720	3692	3058	137	497	—
1971*	4958	1760	3198	2482	240	476	—

* First year in which market pulp capacity was reported by API

Source: American Paper Institute capacity survey, 1981

MACHINE-DRIED WOODPULP CAPACITY

(000 short tons)

Year	Total	Dissolving	Bleached sulfite	Bleached sulfate	Unbleached sulfate	Other
1984e	9772	1590	489	7429	164	100
1983e	9730	1590	489	7387	164	100
1982e	9578	1590	489	7228	170	100
1981e	9423	1590	506	7028	192	107
1980	9156	1590	520	6671	189	187
1979	8575	1536	536	6200	109	194
1978	8192	1573	569	5737	118	194
1977	7975	1648	638	5311	178	200
1976	7904	1571	787	5117	226	202
1975	7900	1671	782	5079	239	131
1974	7975	1824	816	5021	213	102
1973	7710	1759	803	4841	211	97
1972	7503	1756	782	4702	249	11
1971	7404	1769	761	4600	270	4
1970	7247	1768	832	4384	261	1

Source: American Paper Institute capacity survey, 1981

In contrast to the U.S., market pulp accounts for a large share of total Canadian paper-grade woodpulp production, which totaled 11 million metric tons in 1982. Of this total, 38% was consumed on site or by affiliated mills, 6% was shipped as market pulp to domestic mills, 27% was shipped to the U.S. (including roughly 900,000 tons of "tied pulp" shipped by mills affiliated with U.S. companies) and 28% was exported abroad.

North America together with Scandinavia have traditionally been the most important producing regions and in 1982 accounted for 71.7% of total estimated world chemical paper-grade market pulp capacity of 24.68 million tons. Among these "Norscan" countries, Canadian paper-grade market pulp capacity in 1982 was estimated at 6.8 million tons, the U.S. at 4.9 million tons and Scandinavia at nearly 6.0 million tons. Brazil has also recently become an important producer with exports in 1981 totaling 756,000 tons.

The most important consuming regions for chemical paper-grade market pulp are Western Europe, which accounted for 44.0% of total world demand in 1981, followed by the U.S. at 21.0% and Japan at 8.8%.

CHEMICAL PAPER-GRADE MARKET PULPS

North American market **sulfite pulp** production in 1950 exceeded sulfate production, and for many years sulfite pulps were the considered the most desirable type for papermaking. But by 1981 production in the U.S. and Canada of bleached and unbleached sulfite market pulp had dropped to only 624,000 tons and accounted for only about 6% of total paper-grade market pulp production. This trend is expected to gradually continue, with the shutdown of small, older mills and no new sulfite pulp mills being built.

Most sulfite pulp is produced from northern and eastern softwoods (spruce, pines, firs, and hemlocks). One mill in the U.S. South (ITT Rayonier at Fernandina Beach, Fla.) produces paper-grade and dissolving pulp grades from Southern pine. A few U.S. and Canadian mills produce sulfite pulp from hardwoods. Sulfite pulps are still highly desirable for producing high-quality tissue and printing/writing papers.

Sulfate pulp has become the predominant market pulp produced in North America with production in 1981 totaling 9.9 million metric tons, of which 4.1 million tons was produced in in the U.S. and 5.7 million tons was made in Canada. About 9.5 million tons of total U.S. and Canadian production consisted of bleached and semibleached grades, of which 78% was made from softwoods and 22% was from hardwoods.

The most preferred softwood pulps are generally considered to be those from the mills in coastal British Columbia, the U.S. Northwest, interior pulps from B.C. and Alberta, and northeastern softwood pulps from Canada and the U.S. Southern U.S. pine pulps are generally considered to be somewhat lower in quality as the fiber is coarser and produces a poorer sheet for printing/writing grades. But as more Southern pine pulp has become available, papermakers throughout the world have learned how to use it with good results in most printing/writing grades. Nevertheless, Southern

NORTH AMERICAN PAPER-GRADE CHEMICAL MARKET PULP PRODUCTION, CAPACITY, OPERATING RATES

(000 metric tons)

	United States			Canada		
	Production	Capacity	Operating rate	Production	Capacity	Operating rate
1981	4390	4897	89.7%	6081	6810*	89.3%
1980	4437	4653	95.3	6609	6690*	98.8
1979	3733	4202	87.8	6018	6452*	93.3
1978	3300	3691	89.4	5589	6704	83.4
1977	2961	3498	84.6	5351	6660	80.3
1976	3110	3616	86.0	5439	6557	82.9
1975	2794	3560	78.5	4440	6468	68.6
1974	3166	3557	89.0	5663	6330	89.5
1973	3090	3424	90.2	5218	5892	88.6
1972	2996	3349	89.5	4527	5465	82.8

* Based on new method for computing market pulp capacity, so not comparable with data shown for prior years (1970-78). Former method was found to overstate actual capacity, resulting in unrealistically low operating rates.

SOURCES OF U.S. WOODPULP SUPPLY

(000 metric tons)

	U.S. pulp[1] production		Imports from Canada		Imports from other countries		
	Tonnage	%	Tonnage	%	Tonnage	%	Total
1981	47,160[2]	92.7	3,448	6.8	260	0.5	50,868
1980	46,189	92.6	3,494	7.0	180	0.4	49,863
1979	45,914	92.1	3,745	7.5	169	0.4	49,828
1978	45,792	92.6	3,497	7.1	149	0.3	49,438
1977	44,482	92.7	3,338	7.0	168	0.3	47,988
1976	43,020	92.9	3,246	6.8	135	0.3	46,401
1975	39,234	93.4	2,713	6.5	78	0.2	42,024
1974	43,862	92.1	3,597	7.6	143	0.3	47,602
1973	43,842	92.4	3,456	7.3	166	0.3	47,464
1972	42,427	92.6	3,270	7.1	116	0.3	45,813
1971	39,829	92.6	3,071	7.1	118	0.3	43,018
1970	39,505	92.5	3,057	7.2	134	0.3	42,696
1965	30,838	91.6	2,558	7.6	288	0.8	33,684
1960	22,966[2]	91.4	1,843	7.3	317	1.3	25,126
1955	18,815[2]	90.4	1,692	8.1	316	1.5	20,823
1950	13,471[2]	86.2	1,558	10.0	606	3.9	15,635

1. Total woodpulp production, including dissolving pulps, defibrated pulps and screenings.
2. American Paper Institute Raw Materials Group.

Source: U.S. Dept. of Commerce

U.S. EXPORT TRENDS FOR WOODPULP

(000 short tons)

	Total all grades	Dissolving and special alpha	Sulfite		Sulfate			
			Bl	Unbl	Bl	Semibl	Unbl	Other
1981	3678	784	272	12	2419	66	101	61
1980	3806	769	322	26	2403	92	113	76
1979	2784	862	219	38	1632	107	104	52
1978	2599	757	190	20	1400	93	76	62
1977	2640	796	192	8	1294	164	104	81
1976	2518	730	181	12	1301	105	113	74
1975	2564	692	246	22	1337	129	96	41
1974	2802	787	286	25	1442	89	156	17
1973	2344	736	293	6	1105	126	72	5
1972	2252	793	225	2	1024	127	77	3
1971	2175	790	203	10	867	146	150	9
1970	3095	869	359	34	1321	264	253	12
1969	2103	744	251	13	897	152	127	8
1968	1916	671	227	8	638	210	148	12
1967	1720	607	241	13	519	198	132	10
1966	1547	563	219	27	481	139	109	10
1965	1402	535	202	38	363	139	119	6

Source: Bureau of the Census

pine pulps normally sell at a $10 to $20 discount from B.C. and northeastern pulps and in weak markets the discounts may be larger.

Hardwood sulfate pulps are produced in the U.S. Northeast and South, with a small amount also produced in eastern Canada. These pulps find use in printing/writing grades, plus tissue. Southern hardwood pulps are normally sold as mixed hardwoods, with or without oak. Oak and some other species high in vessels have caused excess picking on offset printing grades. However, papermakers in the last 20 years have reduced the picking tendency of oak-containing pulps so that these problems are not too serious for printers. The hardwood pulps, blended with or without softwood pulps, make an exceelent printing/writing grade, providing bulk and a good printing surface. Hardwood market pulps are generally sold at $20 to $30/ton below softwood kraft grades.

SUPPLY/DEMAND TRENDS

The tendency of major integrated companies to shift from being net buyers in tight markets to net sellers in weak markets makes market pulp supply and demand highly cyclical. The heavy international character of market pulp trade and the fact that most pulp is sold in U.S. dollars makes exchange rate fluctuations an important influence. Substantial cost differences between major producing regions also affect market conditions.

The world recession and strong U.S. dollar began to have a noticeable impact on North American and Scandinavian chemical paper-grade market pulp producers in late 1981. Shipments from the five producing countries declined by 3.9% to 15.5 million metric tons in 1981 from the 1980 peak of 16.2 million tons and then dropped 14% in the first half of 1982 compared to the same period a year ago. Weakening market conditions were also reflected in capacity utilization rates which deteriorated from 93% in 1980 to 87% in 1981 and then dropped to 83% for the first six months of 1982.

Despite increasing downtime being taken by producers in Canada and Scandinavia, producer inventories began rising in late 1981 and by mid-1982 had reached 1.8 million metric tons—up from what is considered a "normal" level of 1.3 to 1.5 million tons but still considerably below the all-time peak of 2.9 million tons reached in February 1977, when the Swedish government subsidized inventory building in the last market downturn to keep employment levels up.

Weakening market conditions were most dramatically reflected in eroding pulp prices. In the last upcycle, the price of northern bleached softwood kraft (NBSK) pulp rose for seven consecutive quarters from the final quarter of 1978 to the second quarter of 1980—a climb of about $200/ton or 60%. The price then remained level at $545/metric ton (c.i.f. northern Europe) until the final quarter of 1981 when an increase to $600 was attempted, then rolled back to $580 for the first quarter of 1982, and finally rescinded. NBSK prices then began to erode rapidly in the second

U.S. PRODUCTION OF MARKET WOODPULP

000 short tons (000 metric tons)

Year	Total all grades*		Dissolving and special alpha		Unbl sulfite paper grades		Bl sulfite		Bl & semibl sulfate & soda paper grades		Unbl sulfate paper grades	
1981	6190	(5615)	1337	(1213)	n.a.		n.a.		n.a.		n.a.	
1980	6488	(5886)	1506	(1366)	32	(29)	287	(316)	4376	(3971)	131	(119)
1979	5676	(5151)	1499	(1360)	28	(26)	247	(224)	3727	(3382)	112	(102)
1978	5120	(4647)	1403	(1273)	19	(17)	231	(210)	3289	(2985)	97	(88)
1977	4804	(4358)	1463	(1327)	13	(12)	219	(199)	2895	(2626)	137	(124)
1976	4864	(4413)	1370	(1243)	24	(22)	292	(265)	2999	(2721)	112	(102)
1975	4357	(3953)	1232	(1118)	8.0	(7)	314	(285)	2671	(2423)	87	(79)
1974	5140	(4663)	1610	(1461)	5.2	(5)	391	(355)	2905	(2635)	191	(173)
1973	4925	(4468)	1495	(1356)	21	(19)	465	(422)	2813	(2552)	110	(100)
1972	5025	(4559)	1674	(1519)	13	(12)	467	(424)	2705	(2454)	117	(106)
1971	4634	(4204)	1680	(1524)	11	(10)	406	(368)	2325	(2109)	220	(200)
1970	5446	(4941)	1714	(1555)	60	(54)	529	(480)	2741	(2487)	425	(386)
1969	4855	(4404)	1700	(1542)	58	(53)	514	(466)	2256	(2047)	309	(280)

n.a. = not available
* A small amount of other grades not included

Source: American Paper Institute

1981 PULP EXPORTS FROM MAJOR PRODUCING COUNTRIES

(000 metric tons)

Importer	Exporter					
EUROPE	**USA**	**Canada**	**Sweden**	**Finland**	**Norway**	**Brazil**
Austria	28	14	28	7	5	—
Belgium	105	131	49	41	29	245
Czechoslavakia	2	—	22	27	1	—
Denmark	—	6	55	21	15	—
Finland	—	11	—	—	—	—
France	212	303	443	157	39	—
German Dem. Rep.	5	—	16	16	11	—
Germany, Fed. Rep.	382	481	614	342	98	39
Greece	27	21	48	29	—	—
Hungary	—	3	22	12	—	—
Ireland	5	3	10	6	1	—
Italy	266	489	278	171	26	25
Netherlands	134	172	191	76	43	24
Norway	—	—	76	26	—	182
Poland	—	1	22	1	14	—
Portugal	4	2	19	3	1	—
Romania	9	—	34	4	1	—
Spain	40	58	54	20	8	—
Sweden	10	27	—	6	—	—
Switzerland	19	8	94	40	4	—
United Kingdom	243	306	407	281	87	46
USSR	—	1	44	184	42	—
Yugoslavia	18	29	30	7	3	—
Other	4	5	16	6	15	—
Total Europe	**1,511**	**2,060**	**2,572**	**1,483**	**443**	**561**
NORTH AMERICA						
Canada	60	—	—	—	—	—
United States	—	3,479	25	16	3	105
Total N. America	**60**	**3,479**	**25**	**16**	**3**	**105**
ASIA/AUSTRALASIA						
Australia	38	55	11	11	—	2
China	130	164	33	36	—	3
Hong Kong	1	24	—	0	—	—
India	38	13	6	2	—	—
Indonesia	42	10	6	34	—	15
Iran	—	—	17	8	—	—
Iraq	10	—	23	0	—	—
Israel	7	5	23	17	—	—
Japan	545	795	28	21	—	165
Korea Rep.	125	95	23	4	—	13
Taiwan	51	16	5	6	—	—
Thailand	26	13	14	8	—	—
Turkey	27	2	8	1	—	—
Other	39	29	18	6	—	—
Total Asia/Australasia	**1,071**	**1,203**	**215**	**155**	**1**	**190**
LATIN AMERICA						
Argentina	11	5	—	0	—	44
Guatemala	19	—	—	—	—	—
Mexico	102	46	4	—	—	1
Venezuela	96	23	—	0	—	17
Other	19	12	13	3	—	14
Total Latin America	**266**	**86**	**17**	**4**	**—**	**76**
AFRICA						
Algeria	—	—	7	14	—	—
Egypt	33	—	3	3	—	—
Morocco	1	2	20	0	2	—
South Africa	86	44	—	1	—	14
Other	11	11	27	7	—	1
Total Africa	**131**	**57**	**57**	**26**	**2**	**15**
WORLD TOTAL	**3,039**	**6,885**	**2,886**	**1,685**	**449**	**850**

Source: PULP & PAPER INTERNATIONAL, annual review 1982

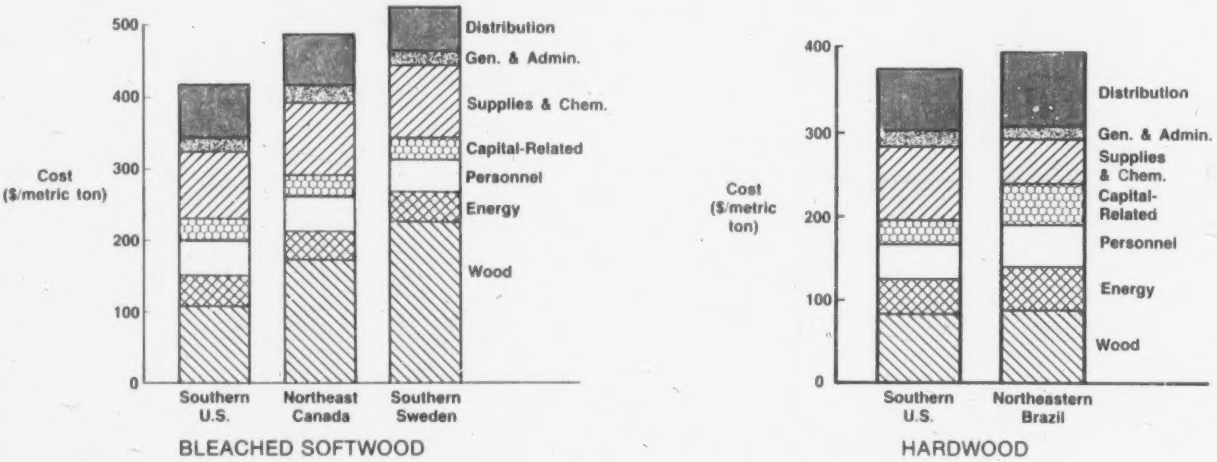
WORLD CHEMICAL PAPER-GRADE MARKET PULP CAPACITY, POTENTIAL PRODUCTION AND DEMAND

(000 metric tons)

	1980		1981		1982	1983	1984
CAPACITY	**Capacity**	**Production**	**Capacity**	**Production**	**Capacity**	**Capacity**	**Capacity**
Canada[1]	6,690	6,605	6,810	6,080	6,810	6,960	7,080
U.S.[1]	4,655	4,455	4,900	4,400	4,940	5,020	5,115
Nordic countries[1]	5,985	5,040	6,130	4,985	5,965	5,790	5,800
N. America/Nordic total	**17,330**	**16,100**	**17,840**	**15,464**	**17,715**	**17,770**	**17,995**
Western Europe[1]	2,560	2,405	2,565	n.a.	2,715	2,770	n.a.
Latin America[1]	2,025	1,880	1,930	n.a.	1,935	2,055	n.a.
Japan[1]	1,070	910	1,070	n.a.	1,070	1,070	n.a.
Others[1]	955	870	1,140	n.a.	1,245	1,195	n.a.
Total	**23,940**	**22,165**	**24,545**		**24,680**	**24,860**	
Potential production total	**22,264**		**22,830**		**23,602**	**23,101**	
DEMAND	**Actual**		**Actual**		**Estimated**	**Estimated**	
Canada	735		750		700	750	
U.S.	4,430		4,325		4,260	4,500	
Nordic countries	1,025		930		875	875	
Western Europe	9,135		9,010		9,060	9,400	
Eastern Europe	470		380		350	345	
Latin America	1,190		865		875	950	
Japan	2,335		1,800		1,825	2,050	
Oceania	335		315		325	340	
Asia Africa	1,775		2,095		2,025	2,275	
Total	**21,430**		**20,470**		**20,295**	**21,485**	
RATIO							
Demand/potential production	**96%**		**90%**		**86%**	**93%**	

1. Potential production = 95% of capacity for Canada, U.S. and Nordic; 90% for Western Europe and Japan; 85% for Latin America and others.
n.a. = not available.
Source: American Paper Institute.

COST COMPARISON: BLEACHED SOFTWOOD MARKET PULP AND HARDWOOD MARKET PULP



BLEACHED SOFTWOOD HARDWOOD

Source: Arthur D. Little Inc., *International Competition in Pulp, Paper and Paperboard: The Future North American Position and Its Implications* (Cambridge, 1983), distributed by Miller Freeman Publications Inc.

quarter and by late summer of 1982 had dropped to $465/metric ton. Discounting began earlier and was more severe in the shorter-fiber hardwood and southern softwood pulps, which through the first-half 1982 were selling $100/ton or more below the longer-fiber northern softwood. This gap began to narrow in the second half with southern softwood selling for $410 to $430/metric ton in northern Europe by late summer and southern hardwood at $370 to $390, with spot discounts below these levels.

COMPARATIVE PRODUCTION COSTS

Contributing to the pressure on prices and demand was the strength of the U.S. dollar in 1981-82 which had the effect of raising the cost of pulp in many foreign currencies by anywhere from 30% to 50% at a time when paper mills were unable to pass on their cost increases.

The appreciation in the dollar also had the effect of making Scandinavian producers—which have been handicapped by significantly higher wood costs—more competitive with North American mills. Commented Björn Sprängare, group CEO of Sweden's MoDoCell: "As a result of the strength of the U.S. dollar, the Swedish forest inducstry currently has roughly the same gross margins in pulp sales in Europe as the North American producers. For the first time in many years, Swedish and North American pulp producers are competing on something like equal terms." Concurred Calvert C. Knudsen, chairman of Canada's MacMillan Bloedel Ltd.: "For the first time in almost a decade our Scandinavian competitors. . .can make market pulp cheaper than we can."

Analyst Ross Hay-Roe, in his *PaperTree Letter*, estimated the 1982 cost for producing bleached softwood kraft pulp (before interest, depreciation or tax and transportation costs) at $356/metric ton in the British Columbia interior, $420 on the B.C. Coast, $456 in Ontario/Quebec, $340 in the South and $405 in Sweden. To illustrate the impact of exchange rates, he noted that while market pulp mill costs for wood, labor, energy, etc. have risen 100% in coastal B.C. and 60% in Sweden in local currencies over a four-year period, the cost increase translated into U.S. dollars has been 90% for coastal B.C. and only 25% for Sweden.

A similar analysis made by Fred G. Robertson, president of Mead Pulp Sales, calculated the first-half 1982 cost (including interest and depreciation) of producing bleached softwood kraft at $357 in western Canada and $362 in the U.S. South, but showed Scandinavia still substantially higher at $483 in Sweden and $462 in Finland. These estimates also exclude freight costs which are lower for Scandinavian producers on shipments to northern Europe and offset some of the advantage held by North American mills. Among bleached hardwood kraft producers, he estimated Brazil had the lowest costs at $327/metric ton, followed by Portugal at $329 and the U.S. South at

ESTIMATED AVERAGE COSTS OF PRODUCING BLEACHED KRAFT PAPER-GRADE MARKET PULP

(U.S.$ per air-dry metric ton)

SOFTWOOD	**First half 1982**	**First half 1981**
Western Canada	(.8008 C$/U.S.$)	(.8375 C$/U.S.$)
Fiber	$138	$138
Chemicals	37	32
Wages & salaries	55	49
Energy	38	—
Other direct	37	70*
Total direct	305	289
Interest	24	25
Depreciation	16	16
Other indirect	12	12
Total	**357**	**357**
Sweden	(5.90 Skr/U.S.$)	(5.54 Skr/U.S.$)
Fiber	212	189
Wages & salaries	85	78
Energy & chemicals	85	87
Total direct	382	354
Capital & misc.	101	99
Total	**483**	**453**
U.S. South		
Fiber	116	108
Chemicals	45	43
Wages & salaries	58	54
Energy	41	46
Other direct	47	43
Total direct	307	294
Interest	20	20
Depreciation	18	18
Other indirect	17	17
Total	**362**	**349**
HARDWOOD		
Brazil	(160.686cruz/ U.S.$)	(93.96cruz/U.S.$)
Fiber	60	43
Labor	29	32
Energy	25	22
Chemicals	36	25
Total direct	150	122
Supplies, capital, misc.	177	191
Total	**327**	**313**
U.S. South		
Fiber	101	96
Chemicals	32	30
Wages & salaries	58	55
Energy	51	64
Other direct	46	42
Total direct	288	287
Interest	20	20
Depreciation	18	18
Other indirect	17	17
Total	**343**	**342**

*Includes energy.
Source: Mead Corp. estimates.

U.S. PRICE INDEXES FOR DOMESTICALLY PRODUCED MARKET PULPS

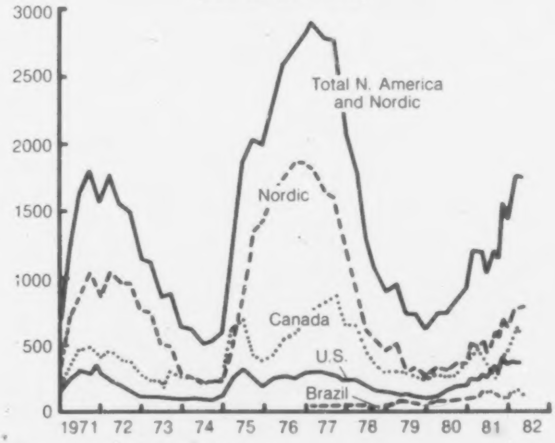
	Papermaking woodpulp (100 = 1967)				
	Bleached sulfate			Bleached	Dissolving pulp-
Year-end	Softwood		Hardwood[1]	sulfite	(100 = Dec. 1973)
1982*	396.2		202.4	403.1	254.0
1981	424.3		239.6	436.7	266.1
1980	399.4		243.2	429.2	239.3
1979	346.3		214.3	n.a.	205.6
1978	274.2		171.5	296.8	189.3
1977	282.1		159.6	263.2	195.4
1976	282.1		179.1	284.9	190.1
1975	283.2		185.0	297.8	180.2
1974	262.9		177.5	266.5	174.2[2]
1973		149.7[3]		150.5	
1972		110.5[3]		113.2	
1971		110.5[3]		113.2	
1970[4]		107.8[3]		108.0	

* End of June.
1. 100 = Dec. 1973
2. This grade classification began in 1974
3. Index for 1970-73 is for bleached sulfate pulp
4. 100 = 1957-59

Source: Bureau of Labor Statistics

PRODUCERS' MARKET INVENTORIES OF CHEMICAL PAPER GRADE PULPS

(000 Metric Tons)



Source: American Paper Institute

$343, while costs were $385 in Finland and $521 in Japan.

Wood costs are the most important factor for these differences in production costs among different regions. According to the Mead analysis, fiber costs in Sweden for bleached softwood kraft were $212/metric ton compared to $138 for western Canada and $116 for the U.S. South. In hardwood, Brazil has by far the lowest fiber costs at $60/ton compared to about $100 for the U.S. South, but this is partly offset by higher capital costs to provide infrastructure for new mills.

FUTURE MARKET OUTLOOK

The pulp market is expected to continue deteriorating through the end of 1982 and into early 1983. Producer inventories will remain high despite substantial production curtailments and prices will continue to erode, with NBSK prices possibly slipping to the $420 to $450/metric ton level by the first quarter of 1983. Tending to slow this erosion, however, was the fact that by late summer 1982 prices were approaching production costs, particularly for the shorter-fiber pulp grades.

The gradual pickup in paper production expected in early 1983 should translate fairly rapidly into increased pulp orders since consumer pulp stocks are extremely low. Producer inventories should begin to come down in the second or third quarter but most analysts do not expect a price increase until the fourth quarter of 1983. Assuming continued economic growth in 1984-85, pulp prices should then advance fairly rapidly, based on limited worldwide capacity expansion, especially for

TYPICAL DOMESTIC U.S. PRICES FOR BLEACHED KRAFT MARKET PULPS

($/short ton)

	Northern bl. softwood kraft	Southern bl. softwood kraft	Southern bl. softwood kraft
1982			
2nd quarter	454/481*	(390/430)*	(330/370)*
1st quarter	513*	(430/455)*	(370/400)*
1981			
4th quarter	513*	455/475*	427/458*
3rd quarter	481	455/475*	427/458*
2nd quarter	481	455/475	427/458*
1st quarter	481	455/475	427/458*
1980			
4th quarter	481	455/475	427/458
3rd quarter	481	455/475	427/458
2nd quarter	481	455/475	427/458
1st quarter	440	419/431	395/405
Year-end			
1979	417	400	365/385
1978	310/340	310/321	290/300
1977	(390/310)*	(260/280)*	(230/240)*
1976	365/372*	315/320*	280*
1975	365/372	328/340	320
1974	350	345	320
1973	235	223	193
1972	162	162	135
1971	150	145	135
1970	171	162	155

Parentheses ( ) reflect substantial contractual tonnage selling below list price levels.
* Significant spot discounting below transaction price levels.

Source: PULP & PAPER WEEK

EXPORT PRICES FOR NORTH AMERICAN BLEACHED SOFTWOOD KRAFT MARKET PULP

($/metric ton, c.i.f. northern Europe)

	Canadian (northern) bl. softwood kraft	U.S. southern bl. softwood kraft
1982		
2nd quarter	(500/545)	(450/500)*
1st quarter	(545)	(500/530)*
1981		
4th quarter	(545)	530*
3rd quarter	545	530
2nd quarter	545	530
1st quarter	545	
1980		
4th quarter	545	530
3rd quarter	545	530
2nd quarter		
1st quarter	490	475
Year-end		
1979	465	450
1978	(375)*	(360)*
1977	(325)*	n.a.*
1976	(390)*	n.a.
1975	410	n.a.

Parentheses ( ) reflect contractual volume selling below list price levels.
* Significant spot discounting below transaction prices.

Source: P&P WEEK

CHEMICAL PAPER-GRADE MARKET PULP CAPACITY OF MAJOR NORTH AMERICAN PRODUCERS

	Annual capacity* (000 metric tons)			
	U.S.	Canada	Total	Capacity share (%)
1. Weyerhaeuser[1,2,3,5]	555	445	1000	8.5
2. Georgia-Pacific[1,2,5]	700	—	700	6.0
3. BC Timber[1,3]	—	580	580	4.9
4. Parsons & Whittemore[1,2]	335	235	570	4.8
5. Great Lakes Forest[1,2,3]	—	570	570	4.8
6. Canadian Forest Products[1,2,3]	—	505	505	4.3
7. B.C. Forest Products[1,3,4]	—	490	490	4.2
8. Procter & Gamble[1,5]**	250	230	480	4.1
9. MacMillan Bloedel[1,3,4]	—	430	430	3.7
10. Noranda[1,2]	—	363	363	3.1
11. Federal Paper Board[1,2]	355	—	355	3.0
12. Boise Cascade[1,4]	105	240	345	3.0
13. International Paper[1,2]	315	—	315	2.7
14. ITT Rayonier[1,5]	305	—	305	2.6
15. Scott Paper[1,2,5]**	230	70	300	2.6
16. CIP[1,4]	—	295	295	2.5
17. Irving Pulp & Paper[1]	—	280	280	2.4
18. Prince Albert Pulp[1]	—	280	280	2.4
19. Mead[1,2]**	148	127	275	2.3
20. Crown Zellerbach[1,2,5]	95	180	275	2.3
21. Donohue St. Felicien[1]	—	265	265	2.3
22. Cariboo Pulp & Paper[1]	—	260	260	2.3
23. Louisiana-Pacific[1,5]	255	—	255	2.2
24. Western Forest Products[1,3,5]	—	250	250	2.1
25. Consolidated-Bathurst[1,2,4]	—	235	235	2.0
26. St. Regis Paper[1,4]**	65	165	230	2.0
27. Bowater[1,3]	230	—	230	2.0
28. Southwest Forest[1,2]	210	—	210	1.8
29. American Can[1,2,3]	35	165	220	1.7
30. Domtar[1,2,5]**	—	180	180	1.5
31. Crestbrook Forest[1]	—	170	170	1.4

North American capacity (1982): 11,753 million tons
Capacity share of top five companies: 29.1%
Capacity share of top ten companies: 48.4%

Key to grades: 1—bleached softwood kraft; 2—bleached hardwood kraft; 3—semibleached softwood kraft; 4—unbleached softwood kraft; 5—bleached sulfite.

* Capacity shares based on equity ownership (excluding less than 50%-owned affiliated which in many cases appear as separate listings).

** Exact market pulp capacity difficult to estimate. Such companies as P&G, IP, Scott, Mead, St. Regis and Domtar captively consume a significant percentage of their total pulp output. Such companies as ITT Rayonier, IP, WFP, and L-P have mills which can produce varying percentages of either paper-grade or dissolving pulp depending on market conditions.

Other smaller North American producers of chemical paper-grade market pulp include: Abitibi-Price (105,000 tpy[1,3,5]); Allied Paper (100,000[1,2]); Chesapeake (115,000[2]); Eddy Forest Prods. (100,000[1,2,3,4]); Lincoln P&P (75,000[2]); Tembec (50,000[5]) and Willamette Industries (130,000[2]).

northern bleached softwood kraft.

A joint survey prepared by paper industry associations in North American and Scandinavia forecasts that total world chemical paper-grade market pulp capacity will rise by only 1.3% from 1981 to 24.86 million tons in 1983. For the main Norscan producing region, there is actually a decrease of 0.7% over this period to 17.77 million tons in 1983—or an increase of 0.9% if the survey is extended out one more year to 1984 when capacity is expected to reach 17.99 million metric tons.

In Canada, chemical paper-grade market pulp capacity is only expected to rise by 4% or 270,000 tons over the three-year period to 7.08 million metric tons in 1984. The largest project is Northwood Pulp & Timber's 260,000-tpy expansion of its Prince George, B.C., bleached kraft softwood pulp mill scheduled to go on stream early in 1983, not all of which is for market sale. The need to strengthen strained balance sheets, high capital costs, and limted fiber supplies in some regions should limit expansion over the next few years.

U.S. capacity is also projected to rise by 4% from 1981 to 5.12 million tons in 1984, which excludes two recently announced major projects that will not have a major impact until 1985. Great Northern Nekoosa and Kymi Kymmene of Finland through their Leaf River Forest Products venture are building a 320,000-tpy bleached kraft softwood and hardwood mill near Hattiesburg, Miss., while International Paper is adding a 300,000-tpy bleached kraft softwood line as part of its Georgetown, S.C., mill conversion—although this will partly be offset by the shift of 100,000 tpy of market pulp at IP's Texarkana, Texas, mill to bleached board production.

Fiber availability is not yet a problem for the South, with its high timber growth rates, year-round harvesting capability and industry reforestation programs. Nevertheless, paper industry expansion in the region is heavily toward integrated operations. Champion International, for example, is installing a 150,000-tpy white paper machine which will consume available market pulp capacity at its Courtland, Ala., mill when the machine starts up in 1984.

Scandinavian chemical paper-grade market pulp capacity is expected to decline by 5% over the three-year period to 5.8 million metric tons in 1984. In Sweden, capacity is expected to decline by 5% to 3.6 million tons, while Finnish capacity declined by 10% to 1.95 million metric tons and only Norway shows a 50% increase from a small base to 210,000 tons. Although a matter of some controversy, Sweden's wood consumption appears to be near the limits of its timber growth, with the wood supply situation in Finland only somewhat better. This is causing Scandinavian producers to integrate forward into printing/writing paper and newsprint production, resulting in a gradual decline in market pulp available for sale to European paper mills.

Outside of the main Norscan producing region, larger percentage capacity increases are planned in such regions as Latin America, Africa and Asia/Oceania—but from small bases and mainly in hardwood pulp grades. Brazil, which has emerged as an important bleached hardwood pulp exporter, has no major new expansions planned for the mid-1980s. The Soviet Union and Eastern Bloc countries also plan a fairly significant 15% increase in chemical paper-grade market pulp capacity to 2.6 million metric tons in 1984, but most of this will probably be for domestic consumption.

MECHANICAL PULPS

Mechanical pulps are produced from either the groundwood, refiner mechanical or thermomechanical pulping processes. Only about 184,000 tons of mechanical market pulp were produced in 1981 by six mills in Canada and one in the U.S. but future growth is expected because of low capital costs and high yields compared to the kraft process.

There are a number of different grades of mechanical pulp on the market at different brightness and freeness levels. With the development of peroxide bleaching in the 1970s, brightness levels up to 75 to 80 Elrepho have become standard. Mechanical pulps offer opacity in newsprint and printing/writing papers and bulk and absorbency in sanitary tissue and disposable diapers. Some mechanical pulp has also been used in boxboard.

Most of the older mechanical market pulp mills use the stone groundwood process, but Finlay Forest Industries operates a recently expanded 140,000-tpy refiner mechanical pulp mill at Mackenzie, B.C., and Quesnel River Pulp recently began operation of a 160,000-tpy market TMP mill at Quesnel, B.C. Quesnel River, a joint venture between West Fraser Timber and Daishowa Paper of Japan, is installing capability to make chemithermomechanical pulp (CTMP) in early 1983. The CTMP will offer higher brightness and freeness than TMP which will also continue to be made at the mill.

A setback for market mechanical pulp was Weyerhaeuser's decision in late 1980 to shut down its 100,000-tpy market TMP mill at Everett, Wash., which mainly had been producing fluff pulp for export to European makers of disposable baby diapers.

NONPAPER PULPS

Dissolving pulps, also referred to as chemical cellulose, are highly purified grades of market pulp, composed of 95% to 99% cellulose. These pulps are used to produce manmade fibers (rayon and acetate), films (cellophane), plastics (cellulose acetates) and chemicals (methyl cellulose and carboxylmethyl cellulose). Two processes are used for producing dissolving pulps, mainly from softwood although some hardwood is used: (1) the prehydrolyzed sulfate process, and (2) the

U.S. AND CANADIAN DISSOLVING PULP PRODUCERS: ESTIMATED CAPACITY[1]

(000 metric tons)

	Company	Prehydrolyzed sulfate pulp	Sulfite pulps	Total[2,3]
1.	ITT Rayonier, total	190	230	420
	Fernandina Beach, Fla.	—	80	
	Jesup, Ga.	190	—	
	Hoquiam, Wash.	—	60	
	Port Angeles, Wash.	—	90	
2.	Buckeye Cellulose Corp. total	275	—	275
	Foley, Fla.	190	—	
	Memphis, Tenn.	85	—	
3.	Alaska Lumber & Pulp Co. Sitka, Alaska	—	210	210
4.	International Paper Co. Natchez, Miss.	190	—	190
5.	Louisiana-Pacific Corp. Ketchikan, Alaska	—	130	130
6.	Tembec Forest Products Inc. Temiscaming, Que.	—	120	120
7.	Western Forest Products Ltd. Port Alice, B.C.	—	100	100
8.	CIP Inc. Hawkesbury, Ont.[4]	—	100	100
9.	Weyerhaeuser Co. Cosmopolis, Wash.	—	80	80
10.	Hercules Inc. Hopewell, Va.	75 CL[5]	—	75
11.	Alpha Cellulose Corp. Lumberton, N.C.	30 CL[5]	—	30
12.	Southern Cellulose Products Inc. Chattanooga, Tenn.	28 CL[5]	—	28

Notes on dissolving pulp capacity

1. The capacity listing at each mill is only for dissolving pulp and special alpha pulps. In most cases, the total mill capacity is higher since paper grade market pulp is also produced.
2. Total U.S. dissolving pulp capacity is 1.418 million metric tons and the true capacity is probably 30% higher or more than the official API figures. For example, the prehydrolyzed kraft mills of IP and ITT Rayonier could produce 100% dissolving pulp. Presently these mills use about 50% or less of their capacity for dissolving pulp. Because there is not enough demand for dissolving pulps, these mills produce paper and fluff grade pulps. Since much of this tonnage is contracted for on a long-term basis, the dissolving capacity is limited more by marketing factors than by production capabilities.
3. Canadian dissolving pulp capacity (1982) at 316,000 metric ton/year is probably overstated.
4. Scheduled for closure, December 1982.
5. Purified cotton linters (CL) is produced for both paper and chemical cellulose users.

Source: PULP & PAPER

modified acid sulfite process. By these processes, a number of grades of varying quality can be made, each suitable for different end-uses.

The quality of a dissolving pulp grade for a particular process depends on its purity and reactivity for a given process. For example, sulfite dissolving pulps are generally considered to be the most reactive pulps and are more suitable for producing rayon and cellophane made under lenient rayon (viscose) processing conditions. Prehydrolyzed sulfate pulps generally produce a stronger rayon fiber for such uses as high-wet-modulus textile rayon and for high-tenacity rayon tire cords. Cotton linter is also used to produce cellulose acetates and cellulose plastics but is rarely used for producing rayon fibers.

Chemical cellulose products can be divided into four groups based on the processes—viscose, acetate, ethers, and nitration—used to convert them: (1) Viscose products are the largest group and consume about 80% of dissolving pulp shipped. About 75% of viscose production consists of rayon for textiles and tire cord, with the remainder going into cellophane and such products as sausage casings and sponges; (2) Acetate products are the second largest group and include textiles, cigaret filters, rigid packaging, photographic film, and high-quality plastics; (3) Cellulose ethers are finding increased use in pharmaceuticals, cosmetics, detergents, food products, superabsorbents and additives for oil-well-drilling muds; (4) Cellulose nitrates are used in explosives, lacquers, printing inks and rocket fuels.

Dissolving pulp producers in recent years have been hurt by sharp cost escalation for wood and energy plus growing acceptance of lower-cost synthetic fibers and films. Rayon staple, for example, has been under heavy competitive pressure from polyester, while plastic films such as oriented polypropylene have been displacing cellophane.

This has been reflected in U.S. dissolving pulp production, which has declined from a peak of around 1.6 million metric tons in the mid-1970s to 1.2 million metric tons in 1981. Canadian dissolving pulp production has followed a similar trend, declining from a peak of 450,000 tons tpy in 1969 to 238,000 tons last year. ITT Rayonier shut down its troubled 260,000-tpy sulfite dissolving and paper-grade pulp mill at Port Cartier, Que., in 1979 and CIP was expected to close its older 91,000-tpy Hawkesbury, Ont., sulfite dissolving pulp mill at the end of 1982.

ITT Rayonier, the largest North American dissolving pulp producer, has predicted that chemical cellulose products will grow at about a 1%/year rate during the 1980s. On a tonnage basis, most of this growth is expected to be in regular rayon staple, principally in demand from Asia. Fastest percentage growth is expected to be in high-performance rayons (such as Rayonier's improved high-wet-modulus Prima staple fiber, said to offer cotton-like quality and high durability) and in cellulose ethers and nontextile acetate uses such as cigaret filters. Other cellulose acetate markets are seen as fairly stable, with the exception of cellophane which is expected to continue to decline.

Some efforts are also being made to improve the viscose process which is highly capital- and energy-intensive and involves use of toxic and flammable chemicals. In the process, cellulose is treated with caustic soda and carbon disulfide to form cellulose xanthate which is then dissolved in a weak caustic solution to form the viscose used to spin rayon staple. Major U.S. rayon producers include American Enka, Avtex Fibers, Courtaulds North America, and North American Rayon Co.

About 24% of world dissolving pulp capacity of 6.1 million metric tons in 1981 is in the U.S. and another 5% in Canada, according to the FAO. The Scandinavian countries account for 10.6% of total capacity, the rest of Western Europe for 10.3%, Japan for 7.3%, Eastern Europe for 8.7% and the Soviet Union for 24.1%. The most important markets are Western Europe, which accounts for about half of total consumption, North America and Japan.

Fluff pulp is produced in either roll or bale form and shipped to sanitary disposable products manufacturers who then disintegrate the thick pulp sheets into individual fibers to provide their products with bulk, softness and high absorbency. The main use has been in baby diapers which account for something like 85% of the fluff pulp market, but incontinent adult diapers, feminine sanitary products, underpads and absorbent bandages are other expanding uses.

The fluff pulp market has been growing at about an 8%/year rate over the past several years, although growth over the past decade has been something like 20%/year. The total market in the western countries is estimated at between 1.4 to 1.6 million metric tons, with about 700,000 or 800,000 tons of consumption in the U.S.

Fluff pulp is made mainly from bleached softwood sulfite and sulfate and is fairly similar to paper-grade pulp but is somewhat more expensive due to special sheet properties and packaging. North American manufacturers include Procter & Gamble, Kimberly-Clark, International Paper, Weyerhaeuser, ITT Rayonier, and Southwest Forest Products in the U.S. and Tembec and Western Forest Products in Canada. Some mechanical pulp, mainly TMP or CTMP, is also being used in Europe.

Procter & Gamble is the largest U.S. consumer of fluff pulp, with about 70% of the diaper market. The remainder of the diaper market is held by Kimberly-Clark with about a 16% share and various private-label producers, the largest of which is probably Weyerhaeuser. A future developing market for fluff pulp is in air-laid manufactured products such as Fort Howard Paper's industrial wipe and James River's reusable kitchen towel.

CANADIAN PRODUCTION OF MARKET PULPS BY GRADES

(000 metric tons)

	Dissolving and special alpha pulps			Sulfite pulp, paper grade		
	Production	Exports	Market[1] pulp	Production[2]	Exports	Market[1],[2] pulp
1981	238	221	275	2202	510	338
1980	271	235	313	2134	504	361
1979	311	241	367	2284	586	368
1978	341	210	334	2303	592	337
1977	230	130	269	2257	645	379
1976	223	147	294	2257	607	449
1975	227	125	228	1959	497	382
1974	384	243	351	2599	674	512
1973	293	208	251	2257	492	348
1972	371	283	233	2237	469	365
1971	389	316	288	2293	503	423
1970	411	302	326	2554	602	576

	Sulfate paper grade[3]			Mechanical pulp		
	Production	Exports	Market[1],[3] pulp	Production[2]	Exports	Market[1] pulp
1981	9152	6197	6247	7956	317	234
1980	9537	5781	5744	7748	270	183
1979	9381	5946	5660	7956	317	234
1978	8858	5545	5252	7910	291	209
1977	7913	5040	5005	7226	276	250
1976	7862	5075	4990	7037	296	261
1975	6396	4181	3657	6007	189	221
1974	8448	5251	5151	7588	262	272
1973	8068	4977	4870	7196	253	274
1972	7157	4525	4162	6967	249	241
1971	6470	4109	3689	6718	210	220
1970	6085	3892	3676	6940	251	279

1. Excludes shipments to affiliated U.S. companies
2. Bleached and unbleached. In 1981 approximately 70,000 tpy was unbleached for market
3. Includes bleached, semibleached, and unbleached pulps. In 1981 approximately 130,000 tons was unbleached market pulp. Approximately 800,000 tpy of kraft pulps are hardwoods and of this about 400,000 tpy is exported
4. Data not available or conflicting

Source: Canadian Pulp & Paper Assn.

CANADIAN CAPACITY FOR MARKET PULP

(000 metric tons)

	Total	Dissolving	Sulfate	Sulfite	Mechanical
1984	7602	324	6672	413	517
1983e	7478	320	6561	400	517
1982e	7327	316	6418	392	517
1981	7127	303	6415	397	317
1980[2]	7270	340	6330	360	240
1979[2]	7112	395	6089	363	265
1978	7381	424	6163	541	253
1977	7273	353	6035	625	260
1976	7221	408	5828	729	259
1975	7156	427	5733	735	261
1974	6955	404	5666	664	221
1973	6502	416	5385	507	194
1972	6084	445	4872	593	174

1. Includes small amount of screenings, about 6000 tpy for recent years.
2. Not comparable with previous years' data due to a change in method for estimating capacity.

Source: Canadian Pulp & Paper Assn.

MECHANICAL MARKET PULP PRODUCERS IN NORTH AMERICA

		Annual metric tons
Quesnel River Pulp	Quesnel, B.C.	160,000 TMP[1]
Acadia Forest Products	Nelson-Miramichi, N.B.	130,000 bl & unbl gwd
Finley Forest Industries	Mackenzie, B.,C.	60,000 RMP[2]
Mohawk Pulp	Chemin du Lac, Que	17,000 gwd
	Riviere-du-Loup, Que.	15,000 gwd
John Breakey	Breakeyville, Que.	20,000 gwd
Tomahawk Power & Pulp	Tomahawk, Wis.	11,000 bl & unbl gwd

1. Mill will also have ability to make CTMP beginning in early 1983, with a new bleach plant to start up midyear.
2. About 80,000 tpy is consumed captively from this 140,000-tpy mill owned by British Columbia Forest Products.

PULP AND PULPING PROCESSES

Before paper can be made, papermakers must be furnished with a supply of fibers capable of producing a paper or board grade with desired strength properties and good runability on paper machines. The primary sources of fiber for papermaking are: (1) pulpwood, 2) wastepaper, (3) nonwood fibers, and (4) inorganic fibers. In the U.S. about 1% of the fiber supplied for paper and board making is from nonwood and inorganic fiber sources such as asbestos or bagasse. About 76% of the fiber supply is derived from pulpwood and 23% from wastepaper.

Pulping is the chemical or mechanical process of freeing fibers from wood. The goal of pulping is to disintegrate or separate wood fiber into its individual fibers without reducing fiber lengths or damaging strength properties. Pulping is accomplished in two ways: either by mechanical or chemical forces, or by a combination of the two. There are many different mechanical and chemical processes for pulping (or cooking) of pulpwood. The pulping process chosen depends on one primary requirement: what grade of pulp is required to make the strength requirements of a specific paper or board grade.

In mechanical pulping, mechanical energy through grinding or attrition is used to separate the fibers from each other. In chemical processes, strong chemicals and high temperatures are used to dissolve the binding material between the fibers, and once these binding materials (lignins) are partially removed or dissolved, the fibers will separate with a minimum of mechanical action, referred to as refining.

PULPWOOD SUPPLY

The pulpwood species used depends on the mill's location and the paper or board grades produced. In the U.S. South, principal species used are Southern pine, mixed hardwood and oak. In the Pacific Northwest the major species used are Douglas fir, hemlock, western pines and small amounts of western cedar, redwood and spruce. In the U.S. Midwest the principal species are mixed hardwoods, oak and spruce. In the U.S. and Canadian Northeast the major species used are eastern spruces, pines, balsam fir and mixed hardwood (poplar, white birch).

Because of increasing pressure on available softwood timber supplies, the percentage of hardwood used for producing pulp is expected to gradually rise. Hardwoods comprise about 36% of the commercial timber supply in the U.S. and about 20% of total timber volume in Canada. In the U.S., hardwoods have grown from only 10% of total pulp production in the mid-1940s to around 25% currently. However, in Canada hardwoods have accounted for only 5% to 10% of pulp produced in recent years—a situation that partly reflects the Canadian industry's concentration on bleached softwood kraft pulp and newsprint.

Pulpwood is delivered to the pulp mill in either chip or log form. In the U.S. Pacific Northwest about 70% of the pulpwood used is sawmill residues. In the U.S. South about 65% of the pulpwood delivered to pulp mills is roundwood. However, increasing amounts of sawmill and wholetree chips are being delivered to southern mills. It is expected that within the next decade as much as 50% of the pulpwood delivered to southern mills will be in the form of chips. In the Northeast, both in Canada and U.S., the majority of pulpwood delivered to mills is in roundwood form; however, even in this area there is a trend to using more sawmill chips. Since many forest product companies are vertically integrated, wastewoods (hogfuel and chips) are delivered to their pulp mills for pulpwood fiber or for energy, consequently lowering their fiber and energy costs.

The concept of using a tree for its greatest value—first using logs for lumber or plywood value and then using the residuals from the sawmills for either energy or pulpwood—has been practiced in the Northwest since the 1920s. As demand for lumber and its associated solid wood products has grown, these

U.S. PULPWOOD CONSUMPTION BY PULPING PROCESS

(000 cords of 128 ft^3)

	1980	1979	1978	1976	1974	1972	1970
All processes, total	79,703	77,594	74,170	72,011	74,327	71,538	67,562
Dissolving and special alpha	3,378	3,248	3,056	2,777	3,953	3,425	3,673
Sulfite, total	3,494	3,348	3,125	4,426	4,722	4,697	5,016
Bleached	2,618	2,433	2,381	3,444	3,565	3,674	3,849
Unbleached and soda	876	916	744	982	1,157	1,023	1,167
Sulfate, total	62,408	60,623	57,944	54,581	55,301	53,085	49,366
Bleached and semibleached	30,110	28,218	26,803	24,697	25,603	23,303	22,327
Unbleached	32,299	32,406	31,141	29,884	29,698	29,782	27,039
Groundwood[1]	4,483	4,115	4,098	4,226	4,413	4,411	4,234
Semichemical	3,853	3,859	3,491	3,609	3,775	3,738	3,456
Defibrated or exploded	2,087	2,401	2,456	2,352	2,162	2,182	1,818

[1] Includes chemigroundwood

Source: Bureau of the Census

U.S. WOODPULP PRODUCTION

(000 short tons)

	Total all grades	Special alpha/ dissolv	Sulfite			Sulfate[1]				Soda[2]	Ground-wood	Semi-chem	Defib/ explod[3]
			Total	Bl	Unbl	Total	Bl	Semibl	Unbl				
1981p	51,783	1,366	1,811	1,407	404	39,596	20,058[4]	n.a.	19,538	(d)	5,069	3,941	n.a.
1980	52,055	1,417	1,911	(d)	(d)	37,296	16,373	1,188	19,735	(d)	4,887	3,938	2,512
1979	51,177	1,447	1,814	(d)	(d)	36,339	15,581	1,182	19,576	(d)	4,619	3,889	2,970
1978	49,694	1,351	1,643	(d)	(d)	35,108	15,218	1,198	18,693	(d)	4,807	3,552	3,233
1977	49,132	1,436	2,012	(d)	(d)	34,064	14,384	1,244	18,436	(d)	4,852	3,542	3,226
1976	47,721	1,443	2,034	1,599	435	32,777	13,696	1,298	17,784	(d)	4,649	3,576	3,242
1975	43,084	1,583	1,951	1,594	357	29,213	12,448	1,396	15,369	(d)	4,351	3,201	2,785
1974	48,349	1,723	2,210	1,840	405	33,012	13,705	1,672	17,635	200	4,711	3,758	2,736
1973	48,327	1,637	2,184	1,810	374	33,045	13,055	1,826	18,165	188	4,670	3,864	2,740
1972	46,767	1,656	2,173	1,827	345	31,826	12,460	1,574	17,792	184	4,639	3,786	2,502
1971	43,903	1,674	2,163	1,809	354	29,551	11,684	1,557	16,309	208	4,462	3,473	2,372
1970	43,546	1,705	2,344	1,931	413	29,472	11,348	1,906	16,217	218	4,404	3,297	2,105

[1] Data shown for the various grades of sulfate pulp are not directly comparable

[2] Soda pulp data are combined with those of sulfate pulp in 1975-81

[3] Includes defibrated and exploded pulps, plus screenings. Screenings estimated at 100,000 tpy

[4] Semibleached sulfate pulp combined with bleached sulfate pulp in 1981.

(d) withheld

Source: Bureau of the Census

U.S. WOODPULP CAPACITY TRENDS

(000 short tons)

	1984e	1983e	1982e	1980	1978	1976	1974	1970
Woodpulp, total	46,471	51,294	53,047	55,214	1,590	1,590	1,590	1,590
Dissolving pulp[1]	1,768	1,824	1,571	1,573	1,909	1,905	1,911	1,946
Sulfite[2]	2,403	2,401	2,417	2,095				
Sulfate & Soda, totals[3]	30,842	34,511	35,875	37,903	39,983	42,187	42,822	43,202
Bleached[4]	11,753	14,522	15,042	18,871	19,695	20,526	20,870	21,195
Semibleached	2,246	1,539	1,539	—[5]	—[5]	—[5]	—[5]	—[5]
Unbleached	16,843	18,451	19,293	19,732	20,288	21,661	21,952	22,007
Semichemical[6]	3,684	4,233	4,402	4,572	4,601	4,826	5,160	5,228
Defibrated & exploded	2,787	3,658	3,571	1,926[7]	1,999[7]	2,020[7]	2,020[7]	2,020[7]
Screenings	156	97	78	65				

1. Includes special alpha pulps
2. Capacity for paper grades only; bleached capacity is about 400,000 tpy
3. Capacity for paper grades only
4. Bleached kraft hardwood pulp capacity is approximately 8.7 million tons
5. Semibleached combined with bleached category
6. Bleached capacity is about 300,000 tpy
7. Excludes the defibrated/exploded pulp capacity of mills that produce hard pressed board.

Source: API capacity survey, 1981; P&P estimates

CANADIAN WOODPULP CAPACITY TRENDS

(000 metric tons)

	1984e	1983e	1982e	1981e	1980[1]	1978	1974	1972
Dissolving & special alpha	324	320	316	303	340	424	404	445
Sulfite	2,479	2,499	2,518	2,580	2,373	2,671	2,833	2,831
Bleached	495	484	467	461	393	580	689	652
Unbleached	1,984	2,015	2,051	2,119	1,980	2,091	2,144	2,179
Sulfate	10,827	10,662	10,381	10,220	10,163	9,591	9,245	7,909
Bl. softwood	6,948	6,807	6,518	6,371	6,252	5,699	5,027	4,087
Semi bl. softwood	1,128	1,122	1,138	1,106	1,198	1,216	1,264	1,209
Bl. hardwood	986	952	953	955	879	852	867	828
Unbleached	1,765	1,781	1,772	1,788	1,834	1,824	2,087	1,785
Semichemical	485	462	449	445	438	455	390	389
Mechanical	10,394	10,140	9,600	8,876	8,550	8,837	8,716	8,554
Defibrated/exploded	537	537	537	537	595	597	584	523
Total[2]	25,046	24,620	23,801	22,961	22,459	22,611	22,225	20,713

1. Data for 1980 and future years not comparable with earlier figures due to change in method of estimating total woodpulp capacity.
2. Includes screenings.

Source: Canadian Pulp & Paper Assn. Capacity Survey, 1981.

concepts have been practiced in the South and thus there are now more chips available for southern mills.

MAJOR PULPING PROCESSES

There are five major pulping processes used by North American pulp mills: (1) **sulfate** (kraft), (2) **sulfite**, (3) **semichemical**, (4) **mechanical**, and (5) **defibrated**. Each of these processes produces a different quality and yield of pulp from wood. The mechanical and defibrated pulps produce low-quality pulp; that is, low in strength, but high in yield. The semichemical pulp, which is principally produced from hardwood, produces an intermediate-quality pulp at medium levels of yield, that is 60% to 80%. The chemical pulps produce the highest quality of pulp but their yields are lowest, that is, 45% to 55%.

Within each pulping group there are major modifications. For example, in sulfate pulping there are high-yield pulps and low-yield pulps. In mechanical pulping processes, pulp can be produced via at least five modified pulping processes. Besides these processes there are two minor chemical pulping processes used: the soda process and the prehydrolyzed sulfate process. The soda process is a soda cook, either using sodium hydroxide or soda ash, and produces a medium-quality chemical pulp from hardwood species. The prehydrolyzed sulfate process produces a dissolving pulp (chemical cellulose) from either hardwoods or softwood and these are used to produce rayon, acetate, cellophane or chemical cellulose products.

In recent years, a few U.S. and Canadian companies have adopted a new processs for pulping, called **oxygen pulping or delignification**. Oxygen pulping is used to remove lignin from an alkaline-treated pulp after pulping with either kraft or soda. As practiced by Chesapeake Corp. of West Point, Va., an oxygen bleaching stage is positioned directly after a first-stage sequential bleaching with chlorine dioxide and chlorination on a kraft hardwood pulp. This process reduces the water pollution load over a conventional bleaching system.

E.B. Eddy Forest Products at Espanola, Ont., also uses an oxygen delignification process but as the first stage of bleaching on softwood kraft pulp and a 50:50 mixture of softwood and hardwood pulp. In 1981, Procter & Gamble started up a new pulp mill at Oglethorpe, Ga., using a two-stage kraft cook, followed by oxygen/soda delignification and three bleaching stages.

Use of **anthraquinone** as a catalyst in kraft and soda pulping has been developed by Canadian Industries Ltd. of Montreal. Mill trials have shown that this organic chemical when applied in a ratio of about 0.10% to 0.15% to softwood in kraft pulping typically improves yield by 2% to 3%, reduces alkali consumption by 10% to 15% and shortens cooking time. The AQ apparently speeds up the removal of lignin, allowing the pulp to

CANADIAN PRODUCTION OF WOODPULP

(000 metric tons)

	Total	Dissolving	Sulfite	Sulfate	Semichemical	Groundwood	Defibrated Exploded
1981	19,977e	238	2,202	8,926	335	7,748	360e
1980	20,693e	271	2,234	9,763	345	7,876	392e
1979	20,728	311	2,284	9,381	354	7,956	397
1978	20,152	341	2,304	8,867	318	7,910	369
1977	18,168	230	2,257	7,913	263	7,226	243
1976	17,947	222	2,257	7,862	269	7,037	260
1975	15,133	226	1,959	6,396	233	6,007	263
1974	19,679	333	2,599	8,448	329	7,588	320
1973	18,562	293	2,257	8,068	350	7,196	344
1972	17,453	370	2,237	7,157	337	6,967	330
1971	16,541	388	2,293	6,470	301	6,718	306
1970	16,609	411	2,554	6,085	295	6,940	259

1. Includes about 40,000 tpy of chemical and mechanical screenings.
2. Bleached sulfite pulp production in 1981 was 478,000 metric tons; unbleached sulfite, 1.7 million tons.
3. Bleached sulfate production in 1981 totaled 6.3 million tons, of which 5.5 million was softwood and 820,000 tons was hardwood. Semibleached sulfate production totaled 1.1 million tons, unbleached was 1.5 million tons.

Source: Canadian Pulp & Paper Assn.

PULPING PROCESSES USED AT NORTH AMERICAN PULP & PAPER MILLS[1]

(Number of installations by state or province)

	Pulp millsites	Sulfite	Kraft	Semi-chemical	Groundwood	Refiner-mechanical[2]	Secondary fiber[3]	Other[4]
UNITED STATES								
Alabama	17		13	1	3	3	4	2
Alaska	2	2						
Arizona	2		1		1		2	
Arkansas	9		7		1	1	2	
California	19		3	1		4	7	
Colorado	—							
Connecticut	3						1	1
Delaware	—							
Florida	10	1	8	1		1		
Georgia	19		12		1	5	5	
Idaho	1		1					
Illinois	9				1	7	3	
Indiana	5			1			3	
Iowa	2			2		1		
Kansas	1						1	1
Kentucky	3		2	1			1	
Louisiana	16		10	4	2	3	4	1
Maine	13	1	7		8	5		1
Maryland	2		1		1			
Massachusetts	3						2	1
Michigan	15		3	3	2	1	6	
Minnesota	9		2		4	3		
Mississippi	8		4		2	3		
Missouri	4					2	1	
Montana	1		1					
New Hampshire	5		1	1			3	
New Jersey	8					3	5	
New Mexico	—							
New York	24	1	1	2	3	2	10	2
North Carolina	16	1	4	1	1	4	1	1
Ohio	16	1	1	2		4	28	2
Oklahoma	5		1	1		2	2	
Oregon	23	5	6	3	3	9	3	1
Pennsylvania	15	1	4	1		3	4	1
Puerto Rico	1							1
Rhode Island	1					1		
South Carolina	6		4	2	2	2	2	
Tennessee	15		2	2	1	4	3	2
Texas	15		6		2	4	2	
Vermont	2				1			
Virginia	15		4	3		4	3	1
Washington	18	6	7	4	2	4		
West Virginia	—							
Wisconsin	24	9	4	2	5	4	10	2
U.S.total	**393**	**27**	**118**	**38**	**45**	**91**	**94**	**20**
CANADA								
Alberta	2		2					
British Columbia	26	1	17		6	3	1	1
Manitoba	4	1	1		2			
New Brunswick	10	3	4	2	4	1		
Newfoundland	2	2			2	1		
Nova Scotia	5	2			3	2		
Ontario	26	7	9	3	11	2	5	
Quebec	44	17	12	1	22	10	4	2
Saskatchewan	1		1					
Canada total	**120**	**33**	**46**	**6**	**50**	**19**	**10**	**3**
North American total	**513**	**60**	**164**	**44**	**95**	**110**	**104**	**23**

1. There are 422 pulp millsites in North America, but many have more than one pulping process. Each individual process is counted in the table above. Closed or temporarily idles mills are included.
2. Includes refiner mechanical pulp (RMP), thermomechanical pulp (TMP), chemimechanical pulp (CMP), and defibrated woodpulp.
3. Includes deinked pulp.
4. Includes bagasse, cotton, flax, hemp, jute, rag.

Source: Post's Pulp & Paper Directory (1983) retain more hemicelluloses.

Since receiving approval for use in pulping by the FDA in 1980, perhaps a dozen North American mills have been using AQ on a fairly regular basis, while many more are still conducting mill trials. It will probably take a few more years to determine whether AQ will come into widespread use. Domestic manufacturing capacity for the chemical must be expanded to improve its cost and availability but chemical suppliers are waiting to see if a market for AQ develops.

BLEACHING SEQUENCE

Bleaching of woodpulp is required to improve its whiteness. Whiteness or brightness is measured optically via a number of instruments in GE brightness units. Bleaching is accomplished by either oxidizing or reducing chemicals. The major oxidizing chemicals are chlorine, hypochlorites, sodium peroxide, and chlorine dioxide. Reducing chemicals are primary hydrosulfites, principally sodium hydrosulfite.

Chemical pulp (sulfite and sulfate) is bleached in large multistage bleach plants by a sequence of treatments. For a kraft pulp, a typical sequence might be: chlorination, caustic extraction, chlorine dioxide, caustic extraction and chlorine dioxide (CEDED). However, many variations are possible. For example, sodium hypochlorite may be used in place of one chlorine dioxide stage or a peroxide stage may be used in the last stage. Fully bleached chemical pulps have brightnesses in the 85 to 90 GE range. Semibleached kraft pulps average around 70 to 75 GE brightness.

Since chlorine dioxide is a strong oxidizing agent, it is more effective in destroying residual organic components than chlorine. Therefore, the pollution load from bleaching can be substantially reduced by substituting chlorine dioxide for chlorine; however, for a given brightness, this will increase bleaching costs. Today, many mills inject some chlorine dioxide before the chlorination stage; such processes are called sequential bleaching.

Reductive bleaching is used for brightening groundwood and deinked pulp. However, oxidizing agents such as peroxides, chlorine, and hypochlorites are also used. These pulps are only brightened to 55-65 brightness and many times this is done in one stage of bleaching. In other cases, two or three stages of bleaching are utilized.

SULFATE OR KRAFT PROCESS

The sulfate or kraft process is the most widely used process for pulping of wood. Since 1950 sulfate has grown from 38% to 67% of total North American pulp production. There are currently about 170 kraft mills in the U.S. and Canada, with a combined output of 45 million metric tons in 1981. Of this, U.S. mills accounted for 36 million tons and Canadian mills about 9 million tons.

In this alkaline process woodchips are cooked under high pressures and temperatures in a solution of sodium hydroxide and sodium sulfide, a solution called white liquor. Woodchips are pulped in large pressure digesters either by batch or continuous processes for one to two hours in a solution of white liquor at temperatures in excess of 170°C (338°F). Depending on the quality of pulp desired, the amount of alkali, cooking time and temperature are varied to produce a pulp of high or low yield on wood. The higher-yield pulps have a higher content of lignin and are normally used for such grades as linerboard and the coarser grades of kraft papers. If a pulp is to be bleached, the kraft pulping stage uses stronger conditions to reduce the pulp's lignin content. Since softwood pulps tend to be higher in lignin than hardwood pulps, more chemical is required to cook the pulp to a given lignin content.

The kraft process is a very versatile process. It produce good-quality pulps from nearly all hardwood and softwood species, chemicals from this process can be economically recovered in a straightforward recovery process, the technology is well understood, and it produces a strong, easily bleachable fiber. The kraft process is also rather attractive from an economic standpoint since the waste materials, called black liquor, can readily be washed from the pulp, concentrated, and burned for recovery of energy and chemicals. A well-designed linerboard mill can be 50% or more self-sufficient in energy by burning the waste liquors.

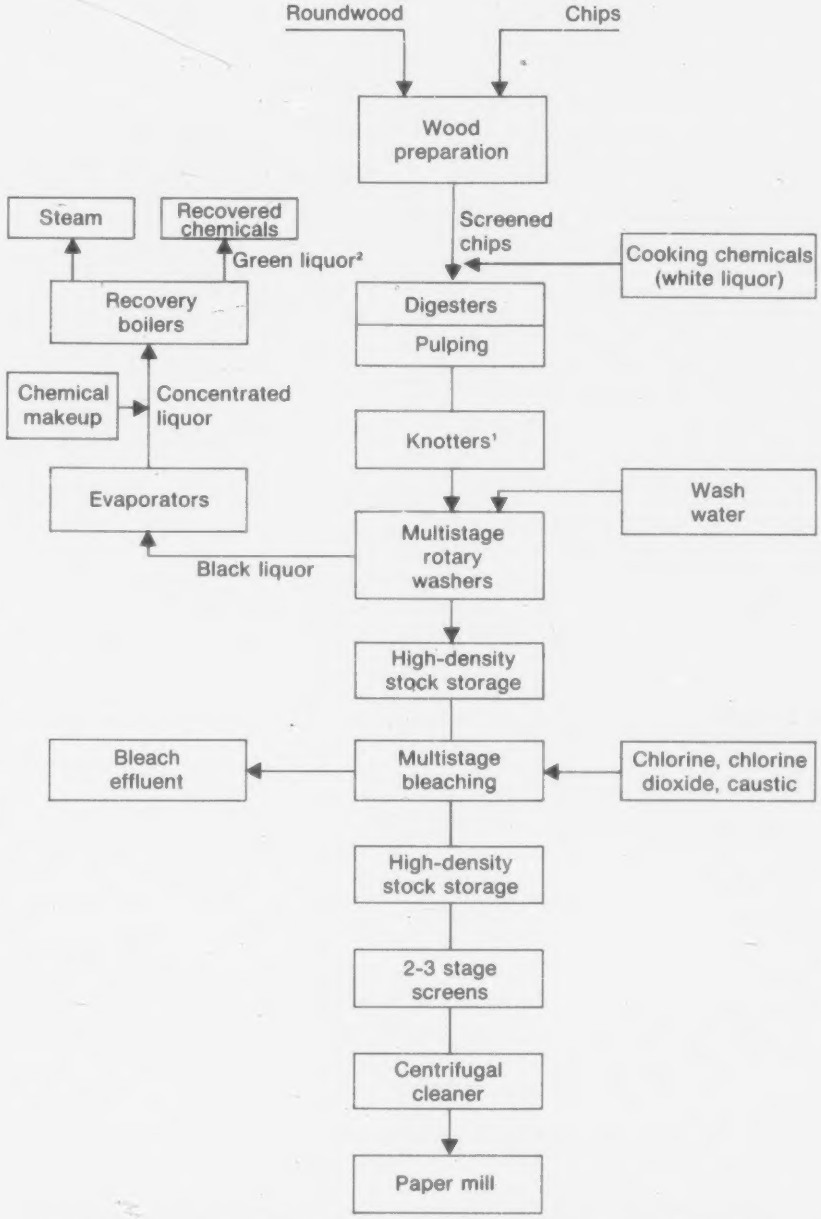
However, the kraft process has certain deficiencies: (1) capital requirements for constructing kraft pulp mills are extremely high (more than $500,000/annual ton) and they must be built with corrosive-resistant metals since the liquors from this process are very corrosive, (2) odor pollution, principally from the sulfur compounds emitted during pulping and recovery, is a serious problem for kraft mills, but with modern pollution-abatement procedures most of these odor emissions can be controlled, (3) the yield of the pulp in the sulfate process is rather low (45% to 55%), (4) explosions caused by molten smelt coming into contact with water present a safety hazard. Nonetheless, the sulfate process will probably continue to be the predominant pulping process for the foreseeable future and it is unlikely that any new chemical pulping process will surpass the advantages of the sulfate process.

SULFITE PROCESS

Acid sulfite pulping is the oldest chemical pulping process used in North America but has been in decline. While U.S. and Canadian kraft pulp production more than quadrupled from 1950 to 1981, sulfite output remained almost flat over this period, totaling 3.8 million metric tons in 1981. Of this, about 1.6 million tons was produced in the U.S. and 2.2 million tons in Canada by a total of 60 mills.

The sulfite process uses an acid solution of sulfurous acid and bisulfite salts with high temperatures to

SIMPLIFIED PROCESS FLOWS FOR KRAFT PULPING


Roundwood
Chips
Wood preparation
Screened chips
Cooking chemicals (white liquor)
Digesters
Pulping
Knotters[1]
Wash water
Multistage rotary washers
Black liquor
Evaporators
Concentrated liquor
Chemical makeup
Recovery boilers
Steam
Recovered chemicals
Green liquor[2]
High-density stock storage
Multistage bleaching
Chlorine, chlorine dioxide, caustic
Bleach effluent
High-density stock storage
2-3 stage screens
Centrifugal cleaner
Paper mill

[1] Some kraft mills use a hot stock refining system before washing. These systems use a refiner to defibrate the unbleached pulp after pulping. The defibrated pulp is then screened bfore washing

[2] Green liquor from recovery is treated in the causticizing process to process white liquor

dissolve the binding lignins holding the fibers together. Pulping is done in large batch digesters, for periods of six to nine hours depending on the quality of the pulp. A wide range of yields can be produced by the sulfite process. High-yield sulfite (normally called bisulfite pulp) is used with newsprint and it has yields of about 55%, whereas chemical-grade acid sulfite pulp has much lower yields in the range of 45%.

A number of different chemical bases are used to produce sulfite pulps. Originally the sulfite pulping process used a calcium base; however, it was difficult and uneconomical to recover the spent liquors from this process. Today sulfite processes are based not only on calcium but also on ammonia, sodium, and magnesium. The sodium and magnesium-based processes offer full chemical recovery, whereas in the ammonia-based process the liquor is burned for energy but not necessarily recovered for its ammonia or nitrogen value. However, the sulfur dioxide from this process can be recovered.

Chemical-grade sulfite pulps find use in fine papers, tissue papers, bristols and other high-quality papers. But sulfite pulps either produced from softwoods or hardwoods have poorer strength properties than their equivalent sulfate pulps. This has prevented their use in areas where high strength is required, such as for linerboard, bag and sack papers.

Among other factors which have caused sulfite to decline from 19% of total North American pulp production in 1950 to only 5.7% in 1981 have been limitations in wood species that can be used, the age and small size of many mills and the slow development of recovery technology.

SEMICHEMICAL PULPING

Semichemical pulping was developed in the late 1920s at the Forest Products Research Laboratory in Madison, Wis., for pulping of hardwoods which were then not used extensively for pulp fiber. Semichemical pulping combines a mild chemical pulping of chips prior to mechanical defibrating. The semichemical pulp produced has a fairly high yield, 60% to 80%, and an intermediate strength level. This pulping process is principally used for pulping of hardwood chips, but softwood chips and sawdust can also be used. Hardwood fibers pulped by the semichemical process produce an excellent pulp for corrugating medium, a grade in which this process finds its main use.

The original semichemical process used was the **neutral sulfite semichemical** process (NSSC). This process pulped hardwood chips in a solution of sodium sulfite at an alkaline pH. To buffer the acids formed during pulping, soda ash was added. When NSSC pulping was first practiced it was accomplished in rotary digesters using batch techniques. With the development of continuous digesters such as the Pandia, M&D and Defibrator, most NSSC pulp mills adopted continuous pulping. In continous digesting retention time is very short, normally not over 30 minutes at temperatures in excess of 170°C (338°F). The spent chemicals and organic materials are either washed or pressed from the pulp, and these are either burned in a fluidized-bed incinerator or in specially designed incinerators or recovery units such as Tampella's recovery unit.

A **nonsulfur**-based semichemical process was developed in the late 1960s by Owens-Illinois. This system uses a solution of sodium hydroxide and soda ash to produce a semichemical pulp of equivalent quality to NSSC pulp and is adaptable to existing processes with only minor modification. About 50% of the NSSC producers have shifted to the no-sulfur, soda-based cook.

MECHANICAL PULPING

In the mechanical process, pulpwood, used in the form of roundwood or chips, is converted to pulp via mechanical energy. The first process used, and still the predominant one, is the **groundwood** process in which short logs are fed against a rotating disc called a grinder, which grinds off fibers and bundles of fibers which are then sluiced with water into a chest beneath the grinder. Since at the interface of the grinder and the log high temperatures are created, there is a plasticizing effect on the lignin and this reduces the energy required to loosen the fibers from the wood mass and also prevents excessive damage to the fiber. However, the fibers produced via grinding are short or choppy but of a very high yield (+90%). These pulps are further refined with refiners to remove shives or bundles and to develop some strength properties.

Groundwood pulps are ideal for bulky sheets requiring good opacity such as newsprint and low-quality printing grades. Obviously they have poor sheet strength and because of this some kraft or high-yield sulfite pulps have to be added to such grades as newsprint to give them enough strength to run on paper machines and printing presses. Groundwood pulp capacity in the U.S. and Canada for paper and board production is about 9.2 million metric tons.

Since grinders must accept logs, it was impractical to use chips for producing mechanical pulps. In the early 1960s, it was discovered that chips could be refined, with or without preheating, in large disc refiners which discharged to the atmosphere. These pulps tended to be of longer fiber lengths than groundwood-prepared pulps from the same species. Consequently they had somewhat better strength but also a slightly lower opacity. This process is called **refiner mechanical pulping** (RMP) and it opened the way for many mills, especially in the Pacific Northwest, to use residual chips for the production of mechanical pulps.

In the late 1960s it was learned that if chips were presteamed and refined under pressure in a disc refiner, a much higher quality of pulp could be obtained. This process, called **thermomechanical pulping** (TMP) has allowed mills to produce a stronger mechanical pulp

GENERAL DESCRIPTION OF COMMERCIAL PROCESSES FOR PULPING WOOD

Pulp classification	Name of process	Process description	Woods used	Yield of pulp by weight, bl/unbl (%)	Strength of pulp (a)	Pulp usage	Final products	U.S. capacity 1982 (000 short tons)	Number of pulp mills in U.S. 1982 (b)
Dissolving	Prehydrolyzed kraft	Woodchips first receive an acid or water hydrolysis to remove pentosans and then are pulped via kraft process. Very high alpha grades receive a cold caustic cold treatment after kraft pulping.	Softwoods: Southern pine Hardwoods: Gum, oak, Southern mixed hardwoods	30-35	Low	Chemically converted into chemicals, plastics, rayon, cellophane, or acetates		625	3
	Sulfite	Woodchips first are pulped under special acid sulfite pulping conditions. Higher purity achieved via pressure heat treatment or cold caustic treatment stages.	Softwoods: Southern pine, Hemlock, Spruce Hardwoods: Eastern	30-35	Low	Same as above		875	6
Chemical (c)	Kraft	Woodchips reduced under steam pressure to pulp with alkaline chemicals (sodium hydroxide and sodium sulfide).	Softwoods	42-55	Softwoods high to very high, hardwoods medium to medium high	Higher yield pulp used for container board. Lower yield pulp used for numerous grades of paper. Often mixed with other pulps.	Strong wrapping and bag paper Container board Book Newsprint Highest grade magazine and other printing papers, Bond, Writing	42,187 total Bleached & semibl softwood--11,843; hardwood--8,683	125
			Hardwoods	44-49					
	Sulfite	Woodchips reduced under steam pressure to pulp with an acid chemical (calcium, magnesium, sodium, or ammonium bisulfite plus sulfurous acid).	Softwoods: Spruce Balsam Hemlock Southern pine Hardwoods: Eastern Lake States	44-49	Softwoods medium to high	Usually mixed with other pulps. When purified, used for cellulose products	Book & magazine Wrapping Tissue Newsprint Glassine Writing Cellulose derivatives	2,011	27

GENERAL DESCRIPTION OF COMMERCIAL PROCESSES FOR PULPING WOOD, continued

Pulp classification	Name of process	Process description	Woods used	Yield of pulp by weight, bl/unbl (%)	Strength of pulp (a)	Pulp usage	Final products	U.S. capacity 1982 (000 short tons)	Number of pulp mills in U.S. 1982 (b)
Chemical, cont.	Soda	Woodchips reduced under steam pressure to pulp with an alkaline chemical (caustic soda).	Mostly Hardwoods: Aspen Cottonwood Basswood Beech Birch Maple Tupelo (gum) Oak	40-48	Medium to medium low	Often mixed with sulfite and other pulps	Book & Magazine Lithograph Other printing papers Envelope Blotting paper	312	2
Semichemical	Neutral sulfite, bisulfite, acid Sulfite kraft, soda or caustic	Woodchips partially softened under steam pressure with chemicals are reduced to pulp by mechanical action.	Hardwoods: Same as for soda pulp Red alder Often pulped in mixtures. Softwoods: Small amounts of Douglas fir Ponderosa pine and sugar pine	60-80	Medium to medium low	Alone in corrugating & some other boards Bleached pulps mixed with softwood pulps for other products.	Corrugating board Food & other specialty boards Glassine Magazine Newsprint Insulating & sheathing board	4,616	39
Chemimechanical	Mason (exploded) Asplund (defibrated)	Woodchips treated with steam or hot water at high temperatures and pressures to soften the wood followed by mechanical fiberization.	Softwoods and hardwoods	80-95	Low to very low	Coarse pulps composed of mixture of single fibers and fiber bundles used alone and mixed with other pulps.	Hardboard Insulating board, Roofing and linoleum felts	1,333	72
	Cold soda	Woodchips given mild treatment with sodium hydroxide solutions and then mechanically fiberized to pulp.	Hardwoods: Birch, Maple Beech, Oak Sweetgums Aspen Bagasse Often pulped in mixtures	80-95	Medium to low to low	Often mixed with other pulps	Printing paper	200	4

GENERAL DESCRIPTION OF COMMERCIAL PROCESSES FOR PULPING WOOD, continued

Pulp classification	Name of process	Process description	Woods used	Yield of pulp by weight, bl/unbl (%)	Strength of pulp (a)	Pulp usage	Final products	U.S. capacity 1982 (000 short tons)	Number of pulp mills in U.S. 1982 (b)
Chemi-mechanical, cont.	Hot sulfite	Woodchips given mild treatment with sodium sulfite solutions and then mechanically fiberized to pulp.	Softwoods: Balsam fir Hemlock Spruce Hardwoods: Birch, Aspen and others	80-95 93-93	Medium to medium low Low	Often mixed with groundwood and sulfite pulps.	Book paper	--	--
Mechanical	Groundwood (GWP)	Wood bolts reduced to pulp by pressing on a revolving grindstone.	Softwoods: Spruce Balsam, pine Hemlock Hardwoods: Aspen, Cottonwood	93-93	Low	Usually mixed with chemical pulp	Newsprint, magazine-book, catalog, tissues, toweling, Boxboard, building board, insulating board	3,361	80 total mechanical
	Refiner mechanical pulp (RMP)	Woodchips are mechanically fiberized in non-pressurized disc refiners.	Same as GWP	93-93	Low but higher than GWP	Blended with GWP or chemical	Newsprint	513	n.a.
	Thermo-mechanical (TMP)	Woodchips are first presteamed and fiberized in pressurized disc refiners. (d)	Same as GWP	90	Low but higher than RMP	Same as above	Newsprint, Publication, Fiberboard	1,996	n.a.

(a) A very general rating based on the full range of pulp strengths. Good strength in a pulp is desirable though not necessarily essential to its usefulness. Between two pulps otherwise comparable, the one with the better strength would be preferred.

(b) Except for kraft and sulfite, nearly every kind of pulp mill must be integrated with a paper or board mill, with excess production being offered for sale. Dissolving pulp mills and some large kraft mills produce pulp for market only. One or two small groundwood pulp mills produce market pulp only, but sales are limited to the local area.

(c) Does not include rayon and cellulose derivative grades.

(d) Some sodium sulfite is also used in TMP process for chemical pretreatment, giving higher pulp strength but slightly lower yield.

SOURCE: Updated by PULP & PAPER from A. D. Little Inc. report for EPA, Environmental Considerations..., Vol. V, Pulp & Paper Industry Report, 1976 than hitherto thought possible from mechanical processes. In a typical TMP process softwood chips are presteamed at 110°C (230°F) for one or two minutes, fed via a press feeder or through a pocket feeder into a pressurized refiner using especially designed plates and then are released under pressure to a stock chest. These pulps are then further refined in a second stage.

Within the last ten years a number of modifications of the TMP process have been made. Some of these processes use chemicals (usually sodium sulfate at various pHs) before and after the TMP stage, other use steaming and nonpressurized first-stage refining, and other use no steaming and presssurized refining (see table showing definitions). Some success has also been reported at a Swedish mill with single-stage TMP refining. TMP pulp is finding wide use in newsprint, coated publication papers, and a few other specialized paper and board grades. When TMP is used in newsprint grades, mills are able to reduce the chemical pulp content in newsprint furnish.

DESCRIPTIONS OF MECHANICAL PULPING PROCESSES

Groundwood pulp (GW) Groundwood produced by atmospheric grinding of logs with a conventional stone grinder

Pressurized groundwood (PGW) Groundwood produced by grinding logs in a pressurized atmosphere with a conventional grinder

Groundwood from chips (FGP) Groundwood produced by atmospheric grinding of chips with a modified grinder. There is no common abbreviation: the FGP is used by the Japanese inventors—F for fine, and GP for groundwood pulp

Refiner mechanical pulp (RMP) Atmospheric refining of untreated chips

Chemirefiner mechanical pulp (CRMP) Atmospheric refining of chemically treated chips

Chemithermomechanical pulp (CTMP) Produced from chips pretreated with chemicals prior to steaming, then refined in pressurized refiner, with or without subsequent pressurized or atmospheric refining stages

Thermomechanical pulp (TMP) Produced from chips first presteamed and refined in one or more stages of pressurized refining, or followed by atmospheric refining

Sodium-sulfite-treated TMP (Opco TMP) Process developed by Ontario Paper Co. which involves treating (cooking) TMP pulp (rather than chips before refining) with sodium sulfite

Sulfonated chip mechanical pulping (SCMP) Patented process of CIP Inc. which is basically chemical pretreatment of chips followed by atmospheric refining (Abitibi-Price and Consolidated-Bathurst both have variations of this process; C-B refers to its process as "Ultra High Yield (UHY," but this process might be called sulfite pulp or CRMP)

Tandem TMP Refers to an arrangement of refiners; for example, single stage only (pressurized); two stages (first only pressurized); three stages (only first pressurized)

TMP is the fastest-growing pulping process and there are now around 4.0 million metric tons of capacity in the U.S. and Canada, and growth is expected to continue. The main drawback to TMP is its high energy requirements, although methods are being found to improve heat recovery.

Another new mechanical pulping process is **pressurized groundwood** (PGW), developed over the past several years by Tampella of Finland. The pulp produced by this process has strength values approaching those of TMP with only two-thirds of the power consumption, or about the same amount of power as required by conventional groundwood. Several PGW installations have been made in Scandinavia, and Madison Paper Co. recently installed four grinders in connection with its new supercalendered paper machine in Maine.

A new method of producing conventional groundwood pulp that permits use of chips has been developed by Oji Paper Co. of Japan and is in commercial operation at its Tomakomai mill.

DEFIBRATED PULP PROCESS

This is the simplest way of preparing pulp and it gives the highest yield with less pollution, but obviously the pulp has very poor strength characteristics. Defibrated pulp can be prepared from either softwoods or hardwoods depending on the products produced or the timber available. The first process used to prepare what we now call defibrated pulp was the Masonite process, which steams chips under pressure in a vessel and releases these chips via a gun or nozzle to atmospheric pressure. The explosion literally blew the pulp into individual fiber masses which were then mixed to make a pulp slurry. This slurry could be used to make coarse grades of paper and board with little or no extra refining. It was ideally suited to make insulation and hardpressed board and its major use today is still for these products.

In the late 1930s Defibrator of Sweden developed the defibrated pulping process. In this process, pulp is fed continuously to a presteaming vessel under slight pressure and reasonably high temperature, discharged through a pressurized refiner at the bottom or end of the pulping vessel where it was defibrated under pressure. The pulp is then discharged to atmospheric pressure either to a live-bottom storage bin or to a stock chest where it is diluted to make a stock slurry. If required, this pulp is again refined, principally to break up fiber bundles and to develop some strength characteristics, and then it is fed to either a cylinder- or fourdrinier-type former.

If the fiber from this process is to be used in a dry process such as producing hardpressed board, it is not diluted with water but stored in a live-bottom bin and then fed through a distributor line onto a forming wire. Capacity for defibrated pulp has grown rapidly during the last 20 years.

DEINKING PROCESS

Deinking is the process of removing inks and in some cases coating and filler from wastepapers, principally newspaper and coated ledgers.

Deinking is primarily practiced at nonintegrated paper mills, and is carried out by two processes: (1) flotation and (2) washing. In the washing system, wastepaper is pulped with chemicals (soda ash, caustic soda, sodium silicates, surfactants, or solvents) in an open pulper either on a continuous or batch basis. The pulp is washed free of ink on conventional rotary washers or on side-hill screens. The washed pulp is then screened and bleached.

Flotation deinking uses air to float off ink particles from the fibers. In flotation deinking, the wastepaper is first added to a pulper with deinking chemicals, cleaned with screens and centrifugal cleaners and then deinked with flotation cells. Typical chemicals used are sodium peroxide, silicates, foamers (a soap), and a collector.

There are currently more than 50 mills in North America deinking wastepaper. More than 45 of these are in the U.S. and five are in Canada. In addition, there are two mills producing gypsum linerboard that have deinking capability, but merely disperse the secondary fiber and as such do not deink.

Tissue mills (about 20 installations) account for nearly half of the mills that are deinking. About a dozen mills use deinked fibers for printing and writing grades, four for liner and boxboard, and seven for newsprint. Several mills owned by Ponderosa Fibres of America and Sonoco Products Co. produce deinked market pulp.

In addition to the two main systems, flotation and washing, several other deinking systems are also used. There are three combination systems which have a washing system coupled with a flotation unit to clean the effluent off the washers.

Regardless of the type of system, the pulper is usually run batch, while the deinking line draws from a storage tank and is run continuously. Systems at Bergstrom Paper Co., Marcal Paper, Southwest Forest Industries, and Perkins Paper Co. are notable exceptions. These systems take pulp out of the pulper continuously and run the deinking line continuously.

Riverside Paper Co. has a unique solvent-extraction system that is used on wastepaper stock such as cupstock, milk carton stock and other difficult-to-clean waste.

THERMOMECHANICAL PULPING CAPACITY TRENDS IN U.S. AND CANADA

(000 short tons)

	Canada	U.S.	Total
1984e	n.a.	2337	n.a.
1983e	3349	2119	5468
1982e	2928	1996	4924
1981e	1645	1723	3368
1980	1229	1371	2600
1979	790	872	1662
1978	600	719	1319
1977	607	567	1174
1976	417	333	750
1975	76	131	207

Source: Canadian Pulp & Paper Assn. and American Paper Institute

U.S. CONSUMPTION OF FIBROUS MATERIALS IN PULP, PAPER AND BOARD MANUFACTURE[1]

(000 short tons)

	1981p	1980	1979	1978	1977	1976	1975	1974	1970
Woodpulp, total	50,937	51,804	51,577	49,694	49,132	47,541	42,431	48,341	43,192
Wastepaper[2]	13,337	12,583	13,012	12,481	12,103	11,874	10,367	12,098	10,594
Mixed	2,886	2,686	2,889	3,149	3,001	3,009	2,761	3,332	3,393
3,140									
News	2,374	2,116	2,131	3,149	3,001	3,009	2,761	3,332	3,140
Corrugated	5,533	5,628	5,737	5,187	4,839	4,618	3,950	4,669	3,511
High-grade pulp substitutes	1,299	1,302	1,401	1,338	1,403	1,323	1,142	1,427	1,377
High-grade deinking	1,250	851	854	786	784	771	650	615	493
Other (Straw, rags, bagasse, etc.)	582	556	681	779	785	700	587	792	780
Cotton linter pulp	n.a.	46	47	46	40	42	37	37	46
49									

1. Woodpulp is also consumed in many nonpaper and board products, such as chemical cellulose, molded pulp products, etc.
2. Census data for wastepaper consumption are lower than that reported by American Paper Institute. See section on Wastepaper.

Source: Bureau of the Census

WASTEPAPER

Wastepaper is used in the pulp and paper industry for repulping in the manufacture of paper and paperboard. Also referred to as as secondary fiber or paperstock, wastepaper is usually less expensive to use than virgin pulp, although its usage is limited because of a lower quality that generally produces a weaker product then woodpulp.

The amount of secondary fiber that is used in overall fiber furnish has remained relatively stable since 1979 at about 23%. In 1980, wastepaper supplied 22.8% of the fiber furnish, decreasing to 22.7% in 1981. It is expected to rise to 23% in 1982 and to 23.3% in 1983, according to the American Paper Institute.

The ratio of wastepaper used in proportion to the total production of paper and paperboard—called the utilization rate—has also varied only slightly in the past decade. Since 1965 it has remained at about 23%, increasing to 23.7% in 1979, and to 24% in 1980 and 1981. The record utilization rate for wastepaper was reached in 1944 (mid-World War II), when wastepaper made up 36% of total paper and paperboard production.

Aside from slightly increased utilization rates and ratios of usage in overall fiber furnish, another encouraging sign for the wastepaper market was a record consumption of wastepaper by U.S. paper and paperboard mills in 1981 of 15.56 million short tons—up 469,000 tons from 1980's record, and 43,000 tons more then 1979's record figure.

CONSUMPTION MEASUREMENTS

The measurement of wastepaper utilization is calculated in proportion to the total production of paper and paperboard. Another indicator of wastepaper consumption is the amount of wastepaper used in relation to the total fiber furnish. The ratio of wastepaper to fiber furnish is slightly less than the utilization rate due to the loss of fiber in papermaking which results in requiring slightly more than one ton of fiber to produce a ton of paper.

Data for wastepaper consumption are collected by the Dept. of Commerce and the American Paper Institute in the U.S., and the Canadian government and Canadian Pulp & Paper Assn. in Canada. API's figures are generally higher than those from Commerce because API includes in-plant and intra-plant use of paper machine trim and broke and some consumption of wastepaper in construction grades, which may not be included in government statistics.

SUPPLY

Sources of wastepaper are generally broadly divided into pre- and post-consumer supplies. Pre-consumer paperstock generators are primarily converting plants which produce such products as containers, bags, envelopes, books and business forms. In the manufacture of these products the plant normally generates waste from machine trims and other manufacturing operations. Post-consumer generators include residential homes, factories, offices, and retail outlets.

Increasing amounts of wastepaper have been generated from the post-consumer segment since recycling became popular in the 1960s. Over 18 million tons of the 68 million tons of paper and paperboard which were used in the U.S. in 1981 were collected for recycling. This represents a recovery rate of 26.6%, and an increase of 33% from the 12 million tons collected in 1970. In the decade 1970-79, the recovery rate ranged from 22% to 25%.

The collection system for each grade of wastepaper differs. Old newspapers are usually generated from the home, and kept for donation to a local paper drive sponsored by a non-profit group to raise money. API estimates that over 50 million, or 25% of the U.S. population were involved in collecting old newspapers in 1981. Of all the newspapers published in the U.S. that year, about 28%, or 3.3 million tons were recycled.

The largest volume of old corrugated containers are generated from retail stores, factories and office buildings. Only one-fourth is supplied by pre-consumer sources. Of the 8.1 million tons of corrugated collected in 1981, only 1.9 million tons was trim or broke from converting plants. The remaining 6.2 million tons of old corrugated containers were generated by post-consumer sources, representing a 36% recovery rate.

Mixed papers are generated mostly by office buildings. They are usually carted away by private haulers. During market slumps haulers usually stop picking up mixed paper because, being the lowest and cheapest of the wastepaper grades, the price usually drops to below a point where it pays to transport it.

More and more large office buildings, like corporate headquarters, are starting to collect office papers to reduce their waste disposal costs and make some money from the sale of wastepaper. Usually this is done by having employees sort their own office waste and carry it to a central collection point in the office building, where it is picked up by a private hauler. The increasing popularity of this practice, however, has not been sufficient to make it a significant factor in waste collection.

GRADES

Mixed papers, news, old corrugated, pulp substitutes and deinking are the five official wastepaper grade categories used by the Commerce Dept., and these are generally used in the industry to market wastepaper. In addition, the Paper Stock Institute of America, a division of the National Assn. of Recycling Industries Inc., subdivides the five classifications into more definitive grades.

These include 47 regular grades which comprise the bulk of the wastepaper traded in the U.S. and Canada along with 33 specialty grades which are sold to a limited number of mills that have the capability to use them in their product mixes because these grades generally include contaminants such as plastic coatings and foil which restrict their usage.

DEFINITIONS

- **Mixed paper:** Paper of varied quality, often office waste; also, boxboard cuttings and mill wrappers.
- **News:** Old newspapers, either collected from households or over-issued at newstands or in-plant; also, groundwood paper trim.
- **Old corrugated containers:** Used corrugated containers; also, container plant cuttings.
- **Pulp substitutes:** Unprinted grades of brown and colored kraft, white and semibleached sheets and cuttings, tabulating cards, and shavings or trim of unprinted grades.
- **Deinking:** Deinked grades of white and colored ledger, computer printout, coated book and groundwood paper, and bleached sulfate sheets and cuttings.

MARKETS

Cheapest of the wastepaper grades is mixed, which is used primarily in construction paper and board production, such as roofing felts and gypsum board. It is also use in manufacturing boxboard grades. The decline in housing starts, and the shift to fiberglass-based roofing felt from paper-based roofing combined with the overall slump in the economy in the U.S. and abroad, which reduced the demand for packaging, caused a severe glut in mixed papers in 1980-81. Weakness in this grade is expected to continue through 1982, as the wastepaper supply and demand balance out.

Linerboard and corrugated medium mills, the major users of old corrugated containers, consumed a fair amount of wastepaper in 1981, although demand diminished later in the year and the slump was continuing early in 1982 due to curtailed business in the U.S and worldwide economic malaise, which had reduced the demand for packaging.

The old news market held up fairly well in 1980-81 due to an increased demand for recycled newsprint, which is the primary market for old news. Consumption of this grade remained largely unchanged, however, due to a dropoff in demand from the housing industry, which uses news in manufacturing various grades of construction paper and paperboard. An estimated 300,000 tpy of old news are also used outside the paper industry in making cellulose insulation.

Use of high-grade deinking and pulp substitutes increased slightly in 1981 from 1980 as tissue mills boosted their usage. Tissue mills, which primarily use white and colored ledger and coated book stock, were beginning to feel the effects of the late-1981 recession going into 1982, however, and demand for the high grades started to slacken by the first quarter of 1982.

The pulp substitutes, which are the cleanest and most expensive of the wastepaper grades, were being hurt by the glut in the virgin pulp market late in 1981. An oversupply of virgin pulp resulted in discounting of pulp to a point where prices for primary and secondary fiber were extremely competitive with each other during 1982.

The high grades command the highest prices of all wastepaper grades and tend to retain a relatively good market even when demand for the lower grades is severely curtailed and prices plummet. This is because the high grades are used in the manufacture of less volatile grades of paper like tissue and printing and writing papers.

Wastepaper prices in general, however, are quite sensitive to the supply/demand situation, and tend to rely heavily on local markets. Typically low prices for most grades, combined with their bulk, make it unfeasible to haul them great distances except during shortages, when prices skyrocket.

Markets are also affected by the export picture. When export markets are good, wastepaper prices are

WASTEPAPER UTILIZATION BY GRADES

(000 short tons)

Year	Total	Mixed papers	%	News-papers	%	Corru-gated	%	Pulp subs*	%	Deink-ing	%
1983e	17,671	2,569	15%	3,095	17%	7,991	45%	2,627	15%	1,389	8%
1982e	17,126	2,519	15	2,985	17	7,695	45	2,571	15	1,357	8
1981e	15,883	2,356	15	2,667	17	7,231	46	2,382	15	1,247	8
1980	15,094	2,268	15	2,564	17	6,866	45	2,254	15	1,142	8
1979	15,520	2,648	17	2,480	16	6,967	45	2,308	15	1,117	7
1978	14,760	2,729	18	2,212	15	6,721	45	2,242	15	1,068	7
1977	14,288	2,773	19	2,287	16	6,205	43	2,079	14	944	7
1976	13,822	2,798	20	2,278	17	5,696	41	2,117	15	933	7
1975	11,983	2,606	22	2,040	17	4,743	40	2,594*	22	—	-
1974	14,196	3,118	22	2,408	17	5,716	40	2,955*	21	—	-
1973	14,318	3,371	24	2,456	17	5,292	37	3,199*	22	—	-
1972	13,132	3,054	23	2,317	18	4,722	36	3,037*	23	—	-
1971	12,323	2,776	22	2,174	18	4,277	35	3,097*	25	—	-
1970	12,021	2,639	22	2,235	19	4,080	34	3,067*	25	—	-

* Pulp substitutes include deinking grades prior to 1976
e = API estimate

Source: API Capacity Survey for relevant years, 1970-81.

UTILIZATION OF WASTEPAPER BY U.S. PAPER/BOARD MILLS

(000 short tons)

Year	Waste-paper used	Paper/board produced	Utiliza-tion rate (%)
1981	15,409	64,496	23.9%
1980	14,922	63,701	23.4
1979	15,361	64,594	23.8
1978	14,706	62,208	23.7
1977	14,058	60,207	23.3
1976	13,622	58,486	23.3
1975	11,748	51,126	22.9
1974	13,982	59,210	23.6
1973	14,094	59,936	23.5
1972	12,925	57,477	22.5
1971	12,106	53,023	22.8
1970	11,803	51,710	22.8

Source: Paper/board production totals and wastepaper utilization from API Capacity Survey for relevant years

WASTEPAPER CONSUMPTION IN U.S. MILLS AS REPORTED BY CENSUS AND API

(000 short tons)

	Census	API
1981	13,377	15,409
1980	12,583	14,922
1979	13,012	15,361
1978	12,586	14,760
1977	12,103	14,058
1976	12,616	13,622
1975	10,367	11,748
1974	12,098	13,982
1973	12,374	14,094
1972	11,703	12,925
1971	11,000	12,106
1970	10,594	11,803

Source: Bureau of Census, M26A data; American Paper Institute, Statistics of Paper

WASTEPAPER PRICES BY REGION, FOR SELECTED GRADES, 1982

($/short ton, f.o.b. sellers dock)

	New York	Chicago	Atlanta	SF-LA
NO. 1 NEWS				
June	25	30	30	30-35
May	25	25	30	30
April	25-30	25	30-35	30
March	25	25	30	25-35
February	25	25	35	25
January	20-25	25	35	25
OLD CORRUGATED CONTAINERS				
June	25	25-30	30	35
May	25	25	30	35
April	20-25	25	30	35-40
March	20-25	25-30	30	30-40
February	20-30	25-30	30	25
January	20-30	30	30	25
NEW DOUBLE LINED KRAFT CORRUGATED CLIPPINGS				
June	50-55	45-50	45-50	65-70
May	50-55	45-50	45-50	65
April	55	45-50	45-50	65
March	45-50	45-50	50-55	65
February	40-45	40-45	40-45	50-60
January	35-40	40-45	40-45	45
PULP SUBSTITUTES, Hard white shavings				
June	180-185	150	145-150	175-180
May	180-185	150	160	175-180
April	185	160	160-170	190
March	175-185	160	160	200
February	185	160	160	200-210
January	175	160	160	190-200
HIGH-GRADE DEINKING, White ledger				
June	90	115	95-100	110-120
May	90	115	110	120-130
April	105	125	110-115	130-140
March	115-120	120-125	110-120	140
February	120-125	120-125	125	140
January	125-130	120	115	130
HIGH-GRADE DEINKING, Colored ledger				
June	70	95	85	75
May	80	95	90-100	80-90
April	80	105	90-100	90-100
March	75-90	105	85-90	100
February	90	105	90	100-105
January	90	105	90	95
HIGH-GRADE DEINKING, Coated book stock				
June	40-45	40	45	45
May	40-45	35-40	45	45
April	40	45	45	45
March	45	45	45	45
February	45	45	45	40-45
January	45	45	45	45

Source: PULP & PAPER WEEK DATABOOK 1980; PULP & PAPER WEEK

U.S. WASTEPAPER PRICE INDEXES

(100 = 1967)

	No. 1 news[1]	No. 1 mixed[1]	Old corrugated boxes[1]	Semi-chemical kraft clippings	Mixed kraft clippings	White news blanks[2]
1981						
December	72.1	164.5	113.3	171.7	182.0	179.0
November	78.4	164.5	113.3	170.5	183.5	179.0
October	78.4	172.3	138.8	222.5	248.1	203.8
September	92.0	187.8	138.8	292.6	331.8	213.3
August	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
July	94.3	187.8	145.2	320.5	365.5	213.3
June	94.3	187.8	145.2	330.1	377.3	213.3
May	94.3	187.8	145.2	327.7	374.3	213.3
April	103.4	197.1	138.8	330.1	377.3	213.3
March	107.0	212.6	145.2	296.3	336.2	213.3
February	113.0	212.6	n.a.	296.3	336.2	213.3
January	125.5	212.6	145.2	296.3	336.2	222.4
Year-end						
1980	125.5	212.6	145.2	296.3	336.2	220.4
1979	199.1	225.0	266.2	354.3	406.6	197.9
1978	157.2	201.7	243.9	255.2	286.3	180.1
1977	304.3	244.4	194.9	215.3	237.8	176.6
1976	185.9	156.7	169.4	164.5	176.2	194.4
1975	155.4	126.5	107.6	158.4	167.4	151.7
1974	88.5	97.8	98.7	191.1	187.9	113.8
1973	228.9	470.2	310.1	268.5	302.4	176.6
1972	106.4	148.4	138.2	162.0	173.2	87.7
1971	123.1	143.8	123.5	133.0	138.0	83.0
1970[3]	123.0	76.9	85.4	87.1	88.6	90.0

1. average of 5 markets
2. average of 4 markets
3. 100 = 1957-59

Source: Bureau of Labor Statistics

good thoughout the country even though the major wastepaper-export markets are off the East and West coasts and Gulf of Mexico. This is due to a rippling effect which tightens the market in other regions as well, although prices usually vary.

When export demand is low it causes a glut that reverberates throughout the market. In 1981, the curtailed export market combined with relatively flat U.S. domestic demand, caused a glut that sent prices plummeting for all grades, although the low grades like mixed, news and old corrugated were more severely affected than the high grades. Dealers were even selling mixed papers for the cost of freight to get rid of it rather than pay the high cost of warehousing it.

EXPORTS/IMPORTS

The U.S. remains by far the greatest exporter of wastepaper, although there was a significant decline in 1981. In that year wastepaper exports dropped by 17% to 2.21 million tons from 2.66 million tons in 1980—a record year—because of weak economies worldwide. Wastepaper exports have been growing at a rapid pace over the past decade, rising from only 408,000 tons in 1970.

Just seven countries together buy most of the wastepaper exported from the U.S.: South Korea, Canada, Mexico, Taiwan, Japan, Italy and Venezuela. In 1981, however, some of these countries' consumption declined in varying degrees.

Mexico bought 345,983 tons in 1981 compared to 589,315 tons in 1980, primarily due to protectionist moves by the Mexican government and railroad tie-ups during most of the year. Italy's consumption dropped to 114,132 tons in 1981 compared to 198,026 tons in 1980. Canada reduced its imports of U.S. wastepaper to 356,532 tons in 1981 from 448,531 tons in 1980. And Japan imported only 84,000 tons in 1981 after taking 201,400 tons in 1980.

Some countries have increased their purchases of U.S. wastepaper, however. Korea imported 518,200 tons in 1981, up from 471,000 tons in 1980. Taiwan consumed 384,837 tons in 1981 compared to 367,090. Venezuela bought 128,718 tons in 1981 compared to 121,849 tons in 1980.

The U.S. imports less than 1% of its wastepaper for use in paper and paperboard mills. The import market has averaged 78,500 tpy during 1978-81. Most of the wastepaper—about 98%—is supplied by Canada.

Of the wastepaper imported from Canada in 1981, 63% was mixed news; 15%, old corrugated; 12%, old news; and 10%, pulp substitutes. Less than 1% was high-grade deinking.

CANADA'S TRADE AND USE

Canada's tight partnership with the U.S. in the wastepaper market has deteriorated slightly in the past two years. Although Canada remains one of the highest consumers of U.S. wastepaper exports, it has dropped into third place from second place in its ranking among top export markets for U.S wastepaper. Now it trails South Korea (highest consumer of U.S. wastepaper exports in 1981) and Taiwan.

The potential of the Canadian market as a major U.S. wastepaper consumer may be stunted in the future by a lack of growth in the ratio of wastepaper used in the overall production of paper and paperboard in Canada. Canada's utilization rate for wastepaper rose to 7.2% in 1977, but dropped to 7% in 1978 and remained there in 1979, the last year for which data is available.

The U.S., however, remains a viable market for Canadian wastepaper. In 1980, the U.S. bought 99,000 metric tons of the total 125,000 tons of wastepaper exported worldwide by Canada. In 1979, the U.S. consumed 89,000 tons of the total 116,000 tons of wastepaper exported by Canada, according to the Canadian Pulp and Paper Assn.

PULPING

Pulping wastepaper is considerably simpler than pulping wood. Primarily the process involves separating the web or sheet into individual fibers. Removal of any ink is considered a separate process and is called deinking.

WASTEPAPER IMPORTS INTO U.S.

(short tons)

1981	79,064
1980	87,104
1979	78,395
1978	69,719
1977	91,013
1976	106,444
1975	71,963
1974	88,927
1973	86,804
1972	88,147
1971	68,244
1970	66,837

Source: Bureau of Census data

WASTEPAPER IMPORTS INTO U.S. BY GRADE

(short tons)

	1980	1981
Mixed papers	55,123	49,724
Printed news	9,904	9,115
Old corrugated	12,748	12,063
Pulp substitutes	8,995	7,925
High-grade deinking	334	237
TOTAL	87,104	79,064

Source: Bureau of Census data

A pulper is generally used in pulping secondary fiber. It is filled with water, and wastepaper is added usually from a conveyor belt until a consistency of at least 5% to 6% wastepaper is reached. A spinning rotor in the bottom of the pulper tears the paper into smaller pieces. These pieces, in turn, rub against each other to further break down the fibers. Stock removed from the pulper normally passes through a screen to remove pieces which have not been sufficiently broken down.

Chemically treated or coated wastepaper which may be more difficult to repulp requires further processing. Usually the water in the pulper is heated to 65°C (150°F), and chemicals such as sodium hydroxide or soaps and dispersing agents, or all of these, are added.

In the deinking operation, washing equipment and special chemicals lift or remove ink from the paper. Some wastepaper, however, is difficult and even sometimes impossible to deink economically because of plastics or pressure-sensitive adhesives in the paper. The cost of deinking can approach the cost of buying virgin fiber in a weak fiber market, thus pricing it out of the market.

GOVERNMENT TARGETS

Local, state and federal governments have become increasingly more involved in recycling in the past decade, even passing laws to promote recycling programs.

Probably the most significant impact of this trend on the wastepaper market came in May 1980 when the U.S. Dept. of Energy established 1987 goals for use of secondary fiber in the manufacture of ten major grades of paper and paperboard. These are shown in the table.

The amount of wastepaper furnish used in the production of unbleached kraft paperboard will show the largest increase in 1987 (from 4% to 10%), according to DOE projections. Printing/writing and building board grades will use less paperstock (from 7% to 6% and 22% to 17%, respectively).

Municipal intervention in recycling, however, could prove damaging to the wastepaper market. Officials in cities which have built plants to use wastepaper as an energy source have increasingly been putting pressure on local residents to channel all their waste to these waste-to-energy plants or resource recovery plants. The federal government allows these municipalities to enact flow ordinances which make it illegal to sell wastepaper to paperstock dealers.

There are currently 34 resource recovery plants in the U.S., and another 22 are due to come on stream in the next few years, according to a recent API estimate. If the wastepaper market cannot absorb consumption of these plants and adjust to any restrictions from local officials, shortages could result.

U.S. WASTEPAPER EXPORTS TO MAJOR CONSUMING COUNTRIES, 1980-81

(000 short tons)

	News	High-grade deinking	High-Grade pulp substitutes	Corrugated	All other	Total	Percent change
Korea							
1980	152.0	54.3	8.3	196.4	59.8	471.0	
1981	175.1	29.7	18.5	169.4	126.0	518.2	+10.0
Canada							
1980	11.8	34.9	88.0	171.1	142.6	448.5	
1981	14.1	28.1	77.3	135.1	101.8	356.5	−27.0
Mexico							
1980	129.2	14.9	66.6	241.4	137.1	589.3	
1981	100.3	15.0	48.7	179.1	2.6	346.0	+41.3
Taiwan							
1980	72.2	22.2	12.9	161.4	98.3	367.0	
1981	94.0	16.2	10.1	149.3	115.2	384.8	+ 4.8
Italy							
1980	7.4	2.3	2.4	91.6	94.1	198.0	
1981	1.4	.6	1.2	75.0	36.5	114.1	−42.4
Japan							
1980	37.7	10.7	10.6	118.0	24.3	201.4	
1981	11.9	3.9	16.5	41.6	10.2	84.0	−58.3
Venezeula							
1980	2.1	2.0	14.7	86.8	16.1	121.8	
1981	6.9	0	1.7	107.0	13.0	128.7	+5.8

Source: NARI from Dept. of Commerce.

U.S. WASTEPAPER EXPORTS, 1970-81

(short tons)

	News	Corrugated	High-grade de-inking	High-grade pulp substitutes	Other	Total
1981	425,060	991,115	130,319	192,192	473,863	2,212,549
1980	424,864	1,208,609	176,442	204,881	649,395	2,664,191
1979	336,138	960,369	134,959	153,950	647,686	2,233,102
1978	366,005	576,653	93,307	92,452	471,032	1,599,449
1977	644,038	591,529	301,273[1]	—	341,526	1,878,366[2]
1976	244,118	426,104	300,096[1]	—	302,418	1,272,626
1975	164,294	333,631	176,145[1]	—	187,318	861,388
1974[3]	—	—	—	—	—	1,307,000
1973[3]	—	—	—	—	—	683,444
1972[3]	—	—	—	—	—	415,033
1971[3]	—	—	—	—	—	419,046
1970[3]	—	—	—	—	—	408,000

1. Includes "high-grade pulp substitutes"
2. Subsequent revision by Census changed total to 1,544,000 tons, due to errors reported in exports to Greece and Canada; revision does not indicate which wastepaper grades are affected by the change
3. No grade designations prior to 1975

Source: Bureau of Census

ESTIMATED 1987 CAPACITY LEVELS AND SECONDARY FIBER USE

(000 tons)

Grade	1987 output	Secondary fiber use	1977 output (reference)
Newsprint	5,111	920	3,871
Tissue	4,975	1,594	4,285
Printing/writing	17,745	1,952	13,848
Packaging, industrial converting	5,780	231	5,378
Unbleached kraft paperboard	18,380	1,878	13,651
Semichemical paperboard	5,580	1,457	4,264
Solid bleached paperboard		0	3,721
Recycled paperboard	8,205	8,854	7,317
Construction paper	2,156	1,186	1,786
Insulating, hard-pressed board	4,670	815	3,682

Source: PULP & PAPER, July 1980

PAPER AND ALLIED PRODUCTS 1987 RECYCLING TARGETS

Grade	1987 target	1977 (reference)	% of total U.S. output
Newsprint	18%	14%	6.3%
Tissue	30	28	6.9
Printing/writing	6	7	22.4
Packaging, industrial converting	4	4	8.7
Unbleached kraft paperboard	10	4	22.1
Semichemical paperboard	26	26	6.9
Solid bleached paperboard	0	0	6.0
Recycled paperboard	108	108	11.8
Construction paper	55	55	2.9
Insulating, hard-pressed board	17	22	5.9

Source: PULP & PAPER, July 1980

U.S. WASTEPAPER DOMESTIC UTILIZATION AND EXPORTS

(000 short tons)

	Used	Exported	Total	Exports as percent of total
1981p	15,409	2,213	17,622	13
1980	14,922	2,664	17,586	15%
1979	15,361	2,233	17,594	13
1978	14,760	1,599	16,359	10
1977	14,058	1,512	15,570	10
1976	13,622	1,273	14,895	9
1975	11,748	861	12,843	7
1974	13,982	1,307	15,289	9
1973	14,094	683	14,777	5
1972	12,925	415	13,340	3
1971	12,106	419	12,525	3
1970	11,803	408	12,211	3

p = Preliminary.
Source: American Paper Institute

WASTEPAPER AS PERCENT OF FIBER FURNISH IN U.S. PAPER/BOARD PRODUCTION

(000 short tons)

Year	Waste paper	Total woodpulp, other fibers	Percent of wastepaper
1983p	17,671	75,806	23.3%
1982p	17,126	74,394	23.0
1981p	15,883	69,952	22.7
1980	15,094	66,122	22.8
1979	15,400	66,703	23.1
1978	14,760	68,780	21.5
1977	14,288	64,087	22.3
1976	13,822	61,904	22.3
1975	11,983	55,087	21.8
1974	14,196	63,326	22.4
1973	14,318	63,876	22.4
1972	13,132	61,164	21.5
1971	12,323	57,128	21.5
1970	12,021	55,823	21.5

Calculated by P&P from API data
p = Preliminary

CONVERTED PAPER AND BOARD PRODUCTS

The converting industry produces marketable products from paper and paperboard. It is a complex industry, making wide variety of products at numerous plants. The average converting plant is small, usually employing less than 100 persons and grossing $10 million or less. But the converting industry is not small. In fact, when sales of all converting industries are combined, they nearly equal the total value of all paper and board manufactured.

Since the converting industry is large and complex, it is not the goal of this report to evaluate it except in a general way. In many cases, it is more practical to discuss converting under the primary manufacturing it relates to; therefore, the reader is referred to sections covering primary paper or board grades for additional information. The following converted paper and board products are discussed here or in other specified sections:

- Corrugated containers and solid fiber boxes
- Setup paperboard boxes (also refer to Recycled Paperboard section)
- Fiber and composite cans, tubes, drums (also refer to Recycled Paperboard section)
- Folding boxboard (also refer to Recycled Paperboard section)
- Sanitary food containers (refer to Bleached Board section)
- Molded pulp products (refer to Molded Pulp section)
- Bags and sacks (refer to Packaging and Industrial Converting Papers section)

The following converted products, while not discussed in the text, are included in the statistical data in this section:

- Die-cut paperboard
- Paper coating and glazing
- Envelopes
- Stationery products
- Converted paper products, not classified

While the printing and publishing industries are not converting industries, they are closely allied to the paper industry; data on these industries are summarized in the introduction to Paper Grades.

CORRUGATED CONTAINERS

Corrugated containers are the workhorse of the packaging industry. More goods and products are shipped in corrugated containers than in any other packaging system.

Corrugated containers are produced from two paperboard grades—linerboard and corrugating medium (refer to sections on Linerboard and Corrugating Medium). Corrugated containerboard is produced on a corrugator which simultaneously flutes the corrugating medium and bonds linerboard to the top and bottom of the medium. Corrugators can produce board in a number of different combinations. The most common construction is produced by combining one ply of medium with two plies of liner (double-wall construction). Other combinations are shown in the figure. Five major types of flutes are formed—A, B, C, D, and E flutes. The choice of flute type is primarily dependent on strength (crush strength) and packaging requirements. Linerboard is principally selected for its strength requirements, burst or mullen.

The corrugated container structure is an ideal package. Few packaging systems offer so much versatility in size and strength requirements. Corrugated containers can be used to package the smallest to the largest retail or commercial products.

Industry structure. Corrugated containers are produced at two types of manufacturing plants—corrugated container plants (converting plants) and sheet plants. Both types of plant make corrugated container blanks, but only the corrugated container plant has a corrugator. Sheet plants purchase rolls or sheets of corrugated paperboard from corrugated

CONVERTING INDUSTRY: SUMMARY OF SELECTED PRODUCT VALUES SHIPPED

($ million)

	1981e	1980	1979	1978	1977	1976	1975	1974	1972
Total	20,634	18,490	16,502	14,521	12,952	10,622	9,326	7,973	6,111
Sanitary paper products	8,630	7,636	6,615	5,591	4,921	4,187	3,647	3,041	1,982
Paper coating, glazing	5,073	4,688	4,086	3,746	3,392	2,653	2,198	2,350	1,650
Die-cut paper and board	1,754	1,454	1,468	1,189	1,058	983	882	884	646
Misc. converted products[1]	2,429	2,187	2,043	1,901	1,698	1,267	1,107	1,073	662
Envelopes	1,577	1,464	1,304	1,121	991	843	806	813	558
Stationery and tablets	920	86	766	747	652	510	483	486	421
Pressed and molded pulps	251	225	220	226	240	219	203	202	162

1

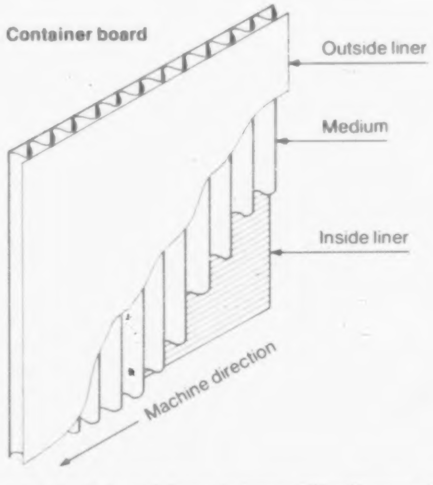
1. Includes wallcovering, gift wrap, industrial products, novelty items, etc.

Source: Bureau of the Census

COMMON FLUTES USED IN PRODUCTION OF CORRUGATED CONTAINERBOARD

	Number of flutes[1] per		Flute height[2]	
Flute	Lineal foot	Lineal meter	inch	mm
A	36	118	3/16	4.76
B	51	168	3/32	2.38
C	39-42	128-138	9/64	3.57
E	96	316	3/64	1.19

[1] Approximate
[2] Exclusive of liners



Source: *Metrication for the Pulp and Paper Industry*, Miller Freeman Publications container plants and cut and print these into container blanks. In 1981, the number of plants totaled 1508, of which 666 were classified as converting plants and 842 as sheet plants.

Over the past several years, the number of small sheet plants has risen due to lower capital costs and levels of technology required. Conversely, the larger and more costly converting plants have declined in number since 1978. Neverless, domestic converting plants, because of their much larger per unit capacity, accounted about 87% of the total volume (square foot basis) of corrugated box shipments in 1981, about the same proportion as in 1972.

The corrugated container industry is highly integrated with paperboard manufacturing, and the majority of converting plants are owned by paperboard manufacturers. Most sheet plants are owned by nonintegrated companies.

Unlike paperboard mills, corrugated container plants operate one to two shifts a day and generally on a 5- to 6-day week. The production units vary in size (with an average of 67 employees per plant) and are located close to their markets, principally near large industrial and urban centers.

The industry has been under severe cost pressure for years, and container prices have lagged behind those of other industrial products. This has forced container plants to stress productivity. By improving equipment and performance, the industry has steadily improved productivity. For example, in 1965 shipments were 43,700 ft^2/week per employee. By 1981 the figure had increased to 73,600 ft^2/week per employee, an increase of 68.4%. However, in the same time frame linerboard prices increased by 204%, and payroll requirements per 1000 ft^2 of combined board by 63.6%.

One technological innovation which could have a major impact is the cold corrugating process, which holds great energy and capital cost savings potential and is currently undergoing commercial evaluation. The process would eliminate all current steam applications and would utilize a heated glue instead, resulting in an estimated savings of $300,000/year for the average box plant.

Outlook. The demand for corrugated containers is directly related to the strength of the economy, as measured by GNP and industry production. Consequently, during recessions the demand for corrugated containers decreases at a percentage which closely follows the dropoff in industrial production. About two-thirds of container shipments are made to nondurable goods markets while the remainder go to durable goods industries. The largest single end-use market is food and beverages which accounts for roughly 35% of total shipments and this and other end-use segments must be taken into account to accurately forecast demand (see table).

The corrugated container industry has suffered through the recent recession but its longer-run outlook is fairly positive. Shipments through the first half of

SUMMARY OF SHIPMENTS OF CORRUGATED CONTAINERS BY END-USE INDUSTRY

	Percent of total sq. footage
1. Food and similar products	36.0%
2. Paper and allied products	10.3
3. Stone, clay, glass products	8.6
4. Chemical and allied products	6.8
5. Rubbert & misc. plastic products	6.3
6. Electrical machinery	5.0
7. Misc. manufacturing products	4.7
8. Fabricated metal products	3.9
9. Furniture and fixtures	3.2
10. Machinery, except electrical	2.4
11. Textile mill products	2.3
12. Transportation equipment	2.1
13. Apparel and fabrics	1.7
14. Printing, publishing & allied industries	1.6
15. Lumber and wood products	1.0

Source: Fiber Box Assn. 1981 annual report

U.S. PRODUCTION OF UNBLEACHED KRAFT AND RECYCLED PAPERBOARD FOR TUBE, CAN AND DRUM STOCKS

(000 short tons)[1]

Year	Kraft	Recycled
1980	220	564
1979	232	628
1978	202	602
1977	180	680
1976	172	702
1975	145	631
1974	213	733
1973	215	763
1972	216	728
1971	159	642
1970	194	573
1969	180	527

[1] Some bleached kraft paperboard is also produced for these uses, but is not included in these data

Source: Bureau of the Census

CONVERTING INDUSTRY: SUMMARY OF PRODUCT VALUES SHIPPED--PAPER AND PAPERBOARD PACKAGING AND CONTAINERS

($ million)

	1981e	1980	1979	1978	1977	1976	1975	1974	1972
Total	25,049	22,408	20,564	18,454	16,832	13,598	12,236	12,402	9,099
Corrugated containers[1]	10,732	9,651	8,976	8,030	7,351	6,530	5,733	5,867	4,197
Bags and sacks	5,718	5,215	4,579	3,926	3,482	1,936	1,760	1,913	1,186
Folding boxboard	3,586	3,277	2,950	2,884	2,579	2,162	1,875	1,807	1,372
Sanitary food containers	2,949	2,430	2,328	2,086	2,048	1,744	1,616	1,506	1,381
Fiber cans, tubes drums	1,542	1,370	1,297	1,119	1,011	1,000	908	909	620
Setup paperboard boxes	522	465	434	409	361	406	344	400	343

e = Estimated

[1] Includes solid-fiber containers

Source: Bureau of the Census

END-USES FOR RIGID PAPERBOXES

(Percentage distribution)

	1981	1980	1978	1976	1974	1970
Textile, apparel, hosiery	5.5%	4.4%	7.3%	3.7%	4.9%	18.9%
Department stores and specialty shops	7.1	6.8	10.1	10.7	10.1	13.1
Cosmetics and soaps	3.9	5.5	3.3	5.3	3.9	6.2
Confections	18.0	12.6	9.0	10.5	9.8	7.9
Stationery and office supplies	9.3	13.5	11.8	12.5	10.4	8.2
Jewelry and silverware	9.7	9.3	10.7	4.2	8.6	3.2
Photographic	4.3	4.5	3.0	2.4	3.2	2.6
Shoe and leather	0.2	0.3	3.7	1.3	7.5	4.4
Drugs, chemical, pharmaceuticals	7.8	7.5	4.9	9.3	7.8	4.2
Toys and games	1.8	1.4	2.1	3.3	1.1	7.0
Hardware & household supplies	4.0	5.5	5.4	6.4	7.7	4.9
Food, beverages	3.9	4.3	2.9	3.6	1.2	0.8
Sporting goods	1.2	1.2	1.2	0.7	1.4	2.6
Other major customers						
Electronics	3.5	3.6	2.9	4.2	2.3	—[1]
Educational	4.4	3.7	5.2	3.9	4.8	—[1]
Other and miscellaneous customers	15.4	15.9	16.5	18.0	15.3	9.6

[1] Listed under other and miscellaneous customers

Source: National Paperbox & Packaging Assn.

SPECIFICATIONS FOR FIBERBOARD BOXES

		Corrugated fiberboard					
		Single wall			Double wall		
Maximum weight of box and contents	Maximum inside dimensions (length, width and depth added)	Minimum combined weight of facings		Minimum bursting test of combined board	Minimum combined weight of facings including center facing		Minimum bursting test of combined board
lb	in.	lb/ 1000 ft²	g/m²	psi	lb/ 1000 ft²	g/m²	psi
20	40	52	254	125	—	—	—
40	60	75	366	175	—	—	—
65	75	84	410	200	92	449	200
90	90	138	674	275	110	537	275
120	100	180	879	350	126	615	350
140	110	—	—	—	222	1084	500
160	120	—	—	—	270	1318	600
275	120	—	—	—	—	—	—

		Corrugated fiberboard Triple wall		Solid fiberboard		
Maximum weight of box and contents	Maximum inside dimensions (length, width and depth added)	Minimum combined weight of facings including center facing	Minimum puncture test of combined board	Minimum combined weight of component plies (exclusive of adhesives)		Minimum bursting test of combined board
lb	in.	lb/ 1000 ft²	in.-oz /in.- tear	lb/ 1000 ft²	g/m²	psi
20	40	—	—	114	556	125
40	60	—	—	149	727	175
65	75	—	—	190	927	200
90	90	—	—	237	1157	275
120	100	—	—	283	1381	350
140	110	—	—	330	1611	500
160	120	—	—	360	1757	600
275	120	264	1100	—	—	—

Source: Based on Uniform Classifications Committee 1972, Uniform freight classification 11—ratings, rules and regulations. Chicago: J.D. Sherson, Tariff Publishing Officer

1982 were off 6.3% from their year-ago level and for the full year are likely to be down 3% to 4% from the 1981 level of 246.2 billion ft^2—which in turn was below the record 250.6 billion ft^2 reached in 1979. Through 1986, shipments are likely to rise at a 2% to 3% annual rate, reflecting the overall growth in the economy. Among factors which should help growth are continuing advances in the development of moisture-resistant containers, increased use of multiple construction to improve box strength, new printing techniques which should improve graphic design and merchandising appeal, and continuing advances in production cost efficiency.

Competition from other packaging systems is not serious but alternate packaging materials are having and will continue to have a negative impact on some container sectors. For example, shrinkcase packaging for canned goods is forecast to displace some container production.

Shrinkcase packaging uses a base made from corrugated containerboard overwrapped with a seethrough polyethylene shrinkfilm. This packaging system is expected to continue to grow at the expense of all-corrugated containers, especially for unitizing shipments of canned, bagged and boxed food products. Other packaging systems, notably foams based on urethane and polystyrene, have limited applications and do not offer the broad-based versatility of corrugated containers.

SETUP BOXES

Setup boxes, made from solid paperboard, are rigid, nonfoldable boxes. The common candy box or shoebox are typical examples. During the last 20 years, setup boxes have lost substantial market shares to folding boxes and plastic packaging, but since setup boxes serve unique applications, they continue to fill the packaging needs of many products.

These boxes are primarily produced from setup paperboard such as white-lined chipboard. In the case of the common shoebox, white-lined chipboard is die-cut and pasted or taped into a rigid packaging structure. However, the basic setup box can be cut to any size, such as a fancy candy box, and overwrapped with decorative coated paper. Also, rigid boxes do not have to be made from setup paperboard. For example, bleached board is commonly used for candy boxes.

Setup boxes are manufactured by small box plants, located close to user markets. In most cases, these boxes

PACKAGING SALES BY PACKAGING MATERIALS FOR 1980

	1980 Shipments[1] ($ billion)	1980 Percent of total
Total packaging sales	$51.2	100%
Paper and paperboard	20.0	39.1
Corrugated containers	9.7	18.9
Folding cartons	3.0	5.9
Paper bag/sacks	5.1	2.6
Sanitary food containers	5.5	2.8
Others	3.7	1.9
Metal	25.5	13.1
Cans	18.9	9.7
Drums and others	6.6	3.4
Other materials	35.4	18.1
Glass	9.2	4.7
Flexible	7.6	3.9
Plastic	6.4	3.3
Wood and textile	3.5	1.8
Closures	2.3	1.2
Others	6.3	3.2

1. Estimated 1980 value of products shipped, Bureau of Industry Economics, Census

SUMMARY OF VALUE OF SHIPMENTS BY END-USES

	1977	1972
Fiber drums		
Product shipments, $ million	226.4	136.9
Paper & board consumed, 000 tons	150.6	160.1
Fiber and composite cans		
Product shipments, $ million	469.9	253.2
Paper & board consumed, 000 tons	211.4	216.1
Cores and tubes		
Product shipments, $ million	259.9	164.3
Paper & board consumed, 000 tons	630.6	624.5
Paperboard cores, reels[1]		
Product shipments, $ million	35.0	31.0
Paper & board consumed, 000 tons	60.3	79.1
Vulcanized fiber products[2]		
Product shipments, $ milion	6.6	14.0
Paper & board consumed, 000 tons	—[3]	34.3
Other, not specified		
Product shipments, $ million	40.8	20.0

1. Includes spools, bobbins, and blocks
2. Includes boxes, cans, tubes, drums
3. Not reported

Source: Bureau of the Census

SUMMARY OF STATISTICS FOR CORRUGATED AND SOLID-FIBER BOX INDUSTRY

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1981e	1,508	101,500	$ 7,351.1	$243.3
1980	—	97,200	9,650.5	432.8
1979	—	103,700	8,975.9	303.0
1978	—	105.800	8.030.3	282.5
1976	—	101,400	6,681.8	185.1
1975	—	94,700	5,820.6	207.9
1974	—	106,800	6,014.6	200.9
1973	—	—	5,229.6	125.0
1972	1,265	107,900	4,308.8	101.5
1971	—	—	3,667.7	87.5
1970	—	—	3,545.0	108.9
1969	—	—	3,500.1	161.9

e = estimated

Source: Bureau of the Census

U.S. CORRUGATED PRODUCTION AND INVENTORY

	Production[1] (billion square feet)			Inventory[3] Containerboard	
	Single wall	Double & triple wall	Total[2]	Tonnage (000 sh tons)	Weeks of supply
1982	—	—	—	2729	9.4
1981	229.8	22.1	253.0	1984	6.2
1980	229.1	21.7	251.9	1979	6.2
1979	236.7	23.2	261.1	1961	5.8
1978	232.8	22.3	256.4	2436	7.2
1977	217.2	20.4	238.8	2527	8.1
1976	207.9	18.6	227.8	2185	7.2
1975	186.2	15.9	203.2	2323	8.2
1974	203.4	19.1	224.1	1595	4.7
1973	216.8	20.2	238.5	1603	5.1
1972	200.9	17.6	220.1	1639	5.7
1971	183.8	15.1	200.3	1879	7.0
1970	177.1	14.1	192.7	1760	6.5

1. Production includes waste and trim before fabrication
2. Total includes single-face production which has averaged around 1.3 billion square feet per year
3. Inventory of linerboard, corrugating medium, and filler board at box plants and paperboard mills based on inventory at January 1 of each year

Source: Fiber Box Assn.

INDUSTRY SUMMARY OF FIBER CANS, DRUMS AND SIMILAR PRODUCTS

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1981e	309	15,200	$1541.9	—
1980	—	15,900	1369.6	$45.6
1979	—	17,100	1296.6	31.2
1978	—	16,300	1118.8	23.6
1977	—	16,100	1011.1	26.7
1976	—	—	935.5	26.6
1975	—	—	837.3	27.5
1974	—	—	828.4	30.5
1973	—	—	673.2	16.8
1972	282	15,700	568.0	17.9
1971	—	—	495.2	16.4
1970	—	—	464.6	16.1
1969	—	—	445.1	16.8

Source: Bureau of the Census

SETUP PAPERBOARD BOXES SUMMARY OF INDUSTRIAL STATISTICS

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1981e	250	12,800	522	—
1980	—	13,500	465	16.2
1979	—	13,400	434	14.6
1978	—	13,700	409	n.a.
1977	—	13,100	361	8.8
1976	—	15,500	402	4.6
1975	—	14,500	350	15.1
1974	—	18,300	387	5.6
1973	—	16,000	320	5.7
1972	395	18,100	321	6.4
1971	19,700	332	8.5	
1970	—	22,000	326	12.0

e = Estimated

Source: Bureau of the Census

are tailored to the individual needs of end-users; consequently there is a close working relationship between the box plant, designers, and users.

In 1981, Census reported 250 setup box plants; of these 147 had 20 or more employees. The total number of employees, including salaried employees, was 12,800, or an average of 51 employees per plant.

Census reports shipment value for this industry at about $490 million in 1981.

FIBER CANS, DRUMS AND TUBES

Composite cans, tubes and cores are produced by the spiral or convoluted winding of paperboard strips around a core or mandel. The paperboard can be recycled board, kraft paperboard, or semichemical board. Strength is produced by the use of two or more plies. If special barriers are required, the board is first laminated with plastics or foil or coated with hotmelts and other specialty coatings. An adhesive such as dextrine is applied to the strips during winding. The endless formed tube is cut on a mandel to desired sizes. For composite cans, either metal or plastic caps are used to seal the ends.

Composite cans are used to package a number of food and nonfood items such as frozen fruit juices, motor oils, snack foods, adhesives, etc. The market has matured in the last few years, mainly because composite cans have not been able to penetrate new high-volume packaging areas, such as occurred in the 1960s for motor oil and juices. The industry has been active in promoting new designs, such as the single-wrap composite can, to open new high-volume markets.

On a sales basis, the approximate markets for composite cans are: (1) frozen concentrated juices, 16%; (2) other food products, including frozen fruits, refrigerated dough products, powdered drinks, and snack foods, 32%; (3) motor oil, 39%; and (4) other nonfood products, 13%.

The core, tube and drum markets have shown reasonably good dollar-value growth, but growth measured by other indicators, such as paperboard consumption, has been slow or negative. A large part of the production of this industry is captive, being produced on-site at paper mills or converting plants.

U.S. PRICE INDEXES FOR COMPOSITE CANS AND DRUMS

(100 = 1967)

	Composite cans			
Year-end	All types	Motor oil cans	Concentrated juice cans*	Fiber drums
1981	285.9	n.a	n.a.	305.5
1980	273.5	265.7	n.a.	275.9
1979	237.1	242.6	239.5	259.3
1978	218.0	222.0	222.6	222.3
1977	200.2	203.0	206.8	211.9
1976	182.0	185.1	186.4	204.4
1975	168.4	166.5	183.7	181.9
1974	159.3	157.3	175.9	181.3
1973	123.8	123.6	121.8	135.4
1972	117.5	117.4	113.8	127.6
1971	113.5	113.3	111.8	121.6
1970#	111.5	111.0	106.7	115.3

* 100 = Dec. 1968
# 100 = 1957-59
Source: Bureau of Labor Statistics, P&P WEEK DATABOOK 1980

U.S. PRICE INDEXES FOR CONTAINERS AND BOXES

(100 = 1967)

Year-end	All[1] types	Corrugated[1] containers RSC	Average[2] national overall corrugated price (\$/1000 ft^2)
1981	249.4	n.a.	39.50e
1980	227.0	231.9	39.50e
1979	207.5	215.2	31.71
1978	184.4	202.5	28.23
1977	167.9	173.4	28.24
1976	165.6	173.4	28.48
1975	160.5	169.9	27.79
1974	157.1	165.2	25.72
1973	128.8	138.5	20.56
1972	118.1	122.6	18.03
1971	112.2	113.2	17.49
1970*	113.3	109.7	17.59

e = P&P estimate
1. Source: Bureau of Labor Statistics
2. Source: Fiber Box Assn.
* 100 = 1957-59

STATISTICAL SUMMARIES
(BASED ON DATA FROM CENSUS BUREAU)

ENVELOPES (SIC Code 2642)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1981e	265	24,200	$1577	—
1980	—	25,600	1460	$55.2
1979	—	24,900	1304	38.7
1978	—	22,900	1121	29.3
1977	—	22,600	991	22.9
1976	—	21,700	870	22.7
1975	—	21,900	830	19.1
1974	—	24,300	868	19.2
1973	—	23,300	690	21.1
1972	247	22,900	621	17.4
1971	—	22,400	573	23.1
1970	—	23,400	574	21.6

Paper consumed (est):[1]	Number envelopes produced:
1977: 677,000 short tons	1977: 97,889 million
1972: 695,000 short tons	1972: 96,599 million

DIE-CUT PAPER AND BOARD (SIC Code 2645)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1981e	371	15,000	$1754	—
1980	—	16,600	1454	$41.0
1979	—	17,000	1468	32.7
1978	—	15,100	1189	26.4
1977	—	14,300	1058	15.3
1976	—	15,300	1027	28.6
1975	—	14,800	943	17.1
1974	—	16,500	923	23.3
1973	—	15,900	747	12.9
1972	374	15,200	676	10.6
1971	—	17,300	612	17.8
1970	—	18,200	612	17.8

Paper and Board consumed (estimated):

Paper	Paperboard
1977: 259,000 short tons	1977: 927,000 short tons
1972: 510,000 short tons	1972: 953,000 short tons

MISCELLANEOUS CONVERTED PRODUCTS (SIC Code 2649)

	Plants	Employees	Value of shipments ($ million)	Capital expenditures ($ million)
1981e	833	29,800	$2429	—
1980	—	29,500	2187	$63.8
1979	—	30.100	2043	86.3
1978	—	30.100	1901	77.6
1976	—	22,800	1288	25.4
1975	—	21,700	1090	29.6
1974	—	24,000	1079	37.7
1973	—	22,000	833	25.4
1972	307	18,100	631	18.5

Paper and paperboard consumed (estimated):

Paper	Paperboard
1977: 424,000 short tons	1977: 169,000 short tons
1972: 495.000 short tons	1972: 112,000 short tons

STATIONERY PRODUCTS (SIC Code 2648)

1981e	242	13,800	$920	—
1980	—	13,000	836	$12.7
1979	—	13,400	766	14.6
1978	—	13,900	747	18.4
1977	—	12,600	652	15.9
1976	—	12,300	653	12.7
1975	—	12,100	591	15.5
1974	—	13,300	605	8.0
1973	—	15,000	493	6.5
1972	431	14,700	450	9.3

Paper consumed (estimated):

1977: 470,000 short tons
1972: 511,000 short tons

PAPER COATING & GLAZING (SIC Code 2641)

1981e	529	41,100	$5073	—
1980	—	45,800	4688	$175
1979	—	49,800	4086	151
1978	—	41,300	3746	91
1977	—	39,700	3392	99
1976	—	39,300	3074	92
1975	—	36,600	2626	108
1074	—	40,800	2645	84
1973	—	39,300	2285	70
1972	426	37,200	1954	52
1971	—	38,400	1832	42
1970	—	38,300	1750	77

Paper consumed (estimated:

1977: 1,562,200 short tons
1972: 1,352,000 short tons

BAGS, EXCEPT TEXTILE BAGS (SIC Code 2643)

1981e	596	49,200	$5718	—
1980	—	54,900	5215	$163.6
1979	—	52,700	4579	129.7
1978	—	49,500	3926	135.1
1977	—	48,700	3482	93.4
1976	—	50,700	3380	93.9
1975	—	48,800	2980	94.5
1974	—	51,600	2867	65.5
1973	—	49,500	2183	51.8
1972	583	48,600	1886	53.9
1971	—	50,300	1772	94.9
1970	—	53,200	1711	81.4

Paper consumed (estimated):

1977: 3,178,000 short tons
1972: 2,616,000 short tons

1. An estimated 13,000 tons of paperboard included for 1977 and 29,000 for 1972
e = estimated

MOLDED PULP PRODUCTS

Molded pulp products are made in a unique wet-forming process invented around the turn of the century, and are considered to be a converted product. Commerce Dept.'s Bureau of Industrial Economics reports there were 38 facilities making molded and pressed pulp products in 1981, with 11 having less than 20 employees and four companies comprising 87% of the U.S. market—which is estimated to be about 250,000 short tpy.

Molded pulp products are made directly from pulp. Fibers are drawn from a liquid slurry onto preformed molds either by vacuum suction or cloth covers that catch the fibers. The maximum possible amount of water—usually 25% to 30%—is first removed mechanically, then the molded pulp is either passed through heated tunnels or pressed between heated dies. The molding, pressing and drying is done in a continuous process.

The furnish is short-fibered, derived either from clean grades of wastepaper or groundwood and hardwood sulfate pulps. The secondary fiber or market pulp is first slurried in a conventional pulper, refined, sized, and then formed.

MARKETS

Molded pulp products are classified into five categories, including (1) consumer, (2) food service, (3) retail food packaging, (4) food distribution, and (5) specialty products. These items should not be confused with solid bleached paperboard products called pressed board, which are machine stamped, or pressed, into a form such as a dish or tray (See chapter on solid bleached paperboard.)

The primary market for molded pulp products is in the consumer sector. Retail food packaging, particularly egg cartons, and food distribution, especially egg trays and fruit packaging trays, are also major markets for molded pulp products.

Consumer products such as disposable tableware are sold in retail stores directly to the consumer. Pressed paperboard reportedly dominates this market, with molded pulp products having the second largest share, an estimated 20% to 25%, and plastics trailing behind with a very small portion of the market.

During the 1970s, competition from plastics cost the pulp and paper industry significant losses in a number of traditional paper markets, including food prepackaging trays (especially meat and fresh produce), egg cartons and fiber pipe. Plastics and molded pulp now each have about a 50% share of the egg carton market. It is not known how much of the meat and produce tray business has been lost to plastics, but it is reportedly

TYPICAL MOLDED PULP PRODUCTS BY END-USE

Consumer products

Tableware
Plates
Dishes

Food packaging

Egg cartons
Meat trays
Poultry trays
Cake circles

Food service

Plates
Trays (bottle, food, etc.)
Carry-out containers

Specialty

Florist vases
Flower pots
Seed pots
Interior packaging
Minnow buckets

Food distributors

Egg cases
Egg trays
Fruit packs

extensive. Bituminous fiber pipe for uses such as sewer and drainage pipe, conduit and fittings, has almost been totally displaced by plastics, according to observers.

Molded pulp shipping trays are sold to food distributors to package fragile products such as eggs and fruits so that they will not be bruised or broken. The rigidity and absorbency as well as the cushioning capabilities of molded pulp trays are considered to make them ideal protective containers for perishables. They are also used to package products such as fluorescent light bulbs, wine bottles, toiletries, electronics, and pharmaceuticals.

Specialty uses for molded pulp include stereo speaker horns, helmet linings, luggage shells, and flower pots made from pulp and peat moss. The drop in demand for nursery products for landscaping that was caused by the erosion in the construction industry in the early 1980s reportedly drove a number of specialty molded pulp producers out of business.

The Bureau of Industrial Economics reported 49 locations making molded and pressed pulp in 1972, and industry observers indicated the figure is now considerably lower than the 38 locations the bureau reported in its 1981 survey. The three major producers are Diamond International Corp., Keyes Fibre Co., and Packaging Corp. of America.

The value of shipments of molded and pressed pulp products rose to $224.2 million in 1980 from $220.2 million in 1979, but actually declined when inflation is taken into consideration, the BIE reports. It estimates that the industry has declined 3.9% overall from 1972 though 1981. The bureau previously forecast an upturn in 1981 to $251.4 million in shipments, but that figure has been revised to reflect a drop of 1% to $222.4 million in 1981 from 1980. A decline of 0.9% is expected in 1982, bringing the market down to $220.4 million.

U.S. PRESSED AND MOLDED PULP PRODUCERS

Diamond International Corp.
  1. Red Bluff, Calif
  2. Natchez, Miss.
  3. Plattsburgh, N.Y.
  4. Palmer, Mass.

Fiber Form Corp.
  5. Columbia City, Ind.

Henry Molded Products Inc.
  6. Lebanon, Pa.

Keyes Fibre Co.
  7. Waterville, Me.
  8. Sacramento, Calif.
  9. Hammond, Ind.
  10. Albertville, Ala.

Lily Tulip Inc.
  11. Old Towne, Maine[1]

Packaging Corp. of America
  12. Macon, Ga.
  Griffith, Ind.

Woodstream Corp.
  Lititz, Pa.

Keeding Inc.
  Milwaukee, Wis.

St. Regis Paper Co.
  16. Marion, Ind.

Saxon Industries Inc.
  17. St. Albans, Vt.

[1] Mill closed

STATISTICS OF U.S. PRESSED AND MOLDED PULP INDUSTRY

	Number of establishments*	Employees (000)	Value of shipments ($ million)
1982e	—	4.6	220
1981	38	5.0	222
1980	—	5.0	225
1979	—	4.6	220
1978	—	5.0	226
1977	37	4.9	240
1976	—	5.3	218
1975	—	5.3	210
1974	—	5.6	205
1973	—	5.6	168
1972	45	6.1	163
1967	58	6.7	145

e = PULP & PAPER estimate
* Data from Census of Manufactures

Source: Bureau of the Census

Imports are expected to continued to exceed exports of molded and pressed pulp products in 1982, with exports projected at $6.3 million compared to $30.0 million in imports. In 1981, exports amounted to $6.1 million compared to $24.5 million in imports. Canada and Mexico were among the principal export and import markets respectively. Saudi Arabia was also a major export market, while Japan and Taiwan were major suppliers to the U.S.

OUTLOOK

Molded and pressed pulp production is expected to continue to decline through 1986 but at a slower rate than in the previous decade, beginning with a drop of 0.9% in 1982, according to the BIE.

Pressed and molded pulp producers are more optimistic about the outlook for the industry, however. They feel some markets will grow by 5%/year or more for the next few years, and are actively pursuing ways to compete with plastics in traditional markets as well as forge new markets. It is felt that the volatility of oil prices is likely to weaken plastics' hold on the market because plastics are petroleum derivatives. Generally, it is felt the market will remain relatively flat because of some market losses to plastics and some market gains in other areas.

One of the most promising new markets is in disposable trays that can be used in both conventional and micowave ovens, observers say. Keyes Fibre Co., which introduce its oven tray line in 1981, began tripling capacity of this product at its Waterville, Maine, mill in 1982. Diamond International Corp. also makes a similiar tray and is quite enthusiastic about its future growth. A number of major frozen food manufacturers are using these trays, and demand reportedly increased by more than 10% in 1982 from 1981 when these trays were first introduced.

Producers are also enthusiastic about the growth in the fast food industry, which they see as a promising future market for molded pulp carryout trays. But, though the market is expected to grow significantly, volume will probably be small relative to the more substantial markets for egg cartons and trays and disposable tableware.

Industry executives also feel that an increase in produce sales—especially the apple market in the northwest region of the country—will boost demand for molded pulp shipping trays an estimated 5%/year for the next few years. They claim packers prefer molded pulp to plastic for trays used in long-distance shipping, both domestically and overseas, and molded pulp is expected to gain an increasing chunk of this market.

CHEMICAL BYPRODUCTS

Numerous chemicals and other byproducts are derived from tree components and from spent pulping liquors. These byproducts, termed "silvichemicals," have become an increasingly profitable and diversified industry in recent years.

There are three primary sources of silvichemicals: (1) sulfite and sulfate pulping processes, (2) pine stumps and pine tree tappings, and (3) wood and bark. Of these three, the chemical pulping processes provide the bulk of silvichemical products. During chemical pulping, 50% or more of the wood is dissolved by the inorganic cooking chemicals. The resulting complex mixture of lignosulfonate salts and wood sugars present in the waste or spent liquor is a rich source of chemical products. Pine stumps and pine tree tappings yield a group of byproducts termed "naval stores," which includes rosin, turpentine, and pine oils. Wood, woodchips, and bark can be distilled or extracted to produce a variety of specialty chemicals.

Silvichemical products can be classified under the following categories: (1) tall oil products, (2) rosin products, (3) turpentine, (4) lignosulfonates, and (5) wood and bark chemical products. Tall oil and turpentine are the major byproducts of the sulfate (kraft) pulping process. Rosin is distilled from pine tree tappings (gum rosin), from pine stumps (wood rosin), and from tall oil (tall oil rosin). Lignosulfonates, the metallic salts derived from the lignin in wood, were formerly produced only from spent sulfite liquor, but are now being made from sulfate black liquor as well. Wood and bark products range from charcoal to ethanol to wax.

The total value of silvichemicals produced in the U.S. as estimated by the 1977 Bureau of Census (the last year for which complete statistics are available) was $528 million (1977 dollars), when using current carload or wholesale prices, f.o.b. mill. Comparing this 1977 total with 1963 total silvichemical production, estimated at $242 million (1963 dollars) which is the equivalent of $516 million (1977 dollars), it would seem the silvichemical industry has been stagnant. In that 14-year period, production values increased only 6%.

However, a different picture emerges when production values for each product group are compared, as shown in the following table:

VALUE OF SILVICHEMICALS PRODUCED IN U.S.

	(millions of 1977 dollars)			% change
Product group	1980	1977	1963	1963-80
Naval stores	99.0	89.2	221.4	− 55
Sulfate mill products	267.6	261.2	179.6	+49
Sulfite mill products	135.8	96.8	40.7	+123

The three major product groups (naval stores, sulfate mill products, and sulfite mill products shifted significantly in importance between 1963 and 1980. The combined annual value of sulfate mill products and sulfite mill products (at constant 1977 dollars) increased by 83% during this 17-year period, while the annual value of naval stores decreased by 55%. Actually, the decline in the annual value of naval stores has been even greater than indicated above, since the second largest revenue-earner in that group, pine oil, is now made primarily from sulfate turpentine.

TALL OIL PRODUCTS

Tall oil is present in the black liquor produced during the sulfate (kraft) pulping process in the form of a crude soap. This soap, approximately 50% resin acids and fatty acids, is skimmed from the surface of the black liquor and boiled with sulfuric acid to remove the residual black liquor and sodium salts, as well as lignin and other impurities. The crude tall oil thus recovered is about 95% rosin and fatty acids and 5% sterols, alcohols, and other materials. The rosin and fatty acids may then be separated through fractionation; or the crude tall oil may be acid-refined, which improves the color and odor, but does not separate the components.

Production of crude tall oil increased at an average annual rate of 4.3% between 1963-1981, reaching 1761 million lb, or 880,500 short tons, in 1981. Production of sulfate pulp increased at an annual rate of 9.5% during the same period. The difference between the increase in tall oil production compared with the increase of sulfate pulp production reflects several factors in the industry including: increased pulping of hardwood; increased use of sawmill residuals and byproduct chips; use of continuous rather than batch digesters; and increased cutting of younger, plantation-grown pine trees.

Improved recovery techniques and increased sulfate pulping of extractive-rich Southern pines have begun to reverse the decline in tall oil yields, however. In 1980, about 76% of the U.S. softwood sulfate paper grade pulp capacity (30.7 million tpy) was based in the South. Between 1975 and 1981, production of crude tall oil rose at an average annual rate of 7.2% from 1228 million lb in 1975 to 1761 million lb in 1981.

Trends in the production of the three major tall oil fractions (rosin, fatty acids, and distilled tall oil, including acid-refined tall oil) are shown in Table 1. Tall oil fatty acids (TOFA) in recent years have experienced the greatest revenue increase of the three fractions. In 1980 they had an annual wholesale value of $102 million f.o.b. mill, or about $6 million less than the annual value of tall oil rosin that year. In 1961 the annual value of tall oil rosin production was twice that of TOFA.

Currently the major U.S. tall oil fractionators are Arizona Chemicals, Hercules, Union Camp, Reichhold Chemicals, Sylvachem, Westvaco, Monsanto-Emery, and Georgia-Pacific. In the late 1950s and early 1960s, surface coatings were the largest single end use for domestic tall oil fatty acids. However, as the following breakdown shows, intermediate chemicals now account for about half the total U.S. TOFA consumption: Dimer acids for use in polyamide resins for ink, adhesive, and special coating applications are the most important intermediate chemicals, accounting for nearly two-thirds of the TOFA consumption in this category. Other chemicals under this heading are:

- Epoxidized esters used as a plasticizer/stabilizer system for PVC resins
- C-21 diacid surfactants made by reacting acrylic acid with the linoleic content of TOFA and then removing the unreacted oleic acid.

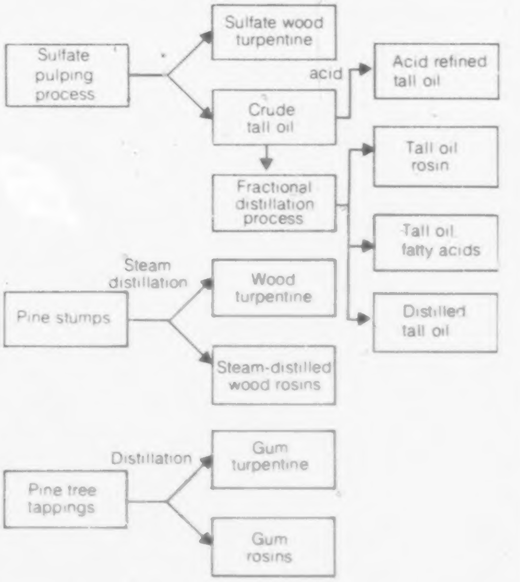
PRODUCTION OF CRUDE TALL OIL AND TALL OIL FRACTIONS IN U.S., 1963-81

(million lb)

Year	Crude tall oil[1]	Tall oil rosin	Tall oil fatty acids[2]	Distilled tall oil[1]
1981	1761	444	407	109
1980	1754	448	407	103
1979	1697	464	416	113
1978	1616	424	388	115
1977	1518	406	359	103
1976	1484	410	374	85
1975	1228	342	293	75
1974	1213	366	363	82
1973	1329	443	412	82
1972	1293	437	429	92
1971	1268	419	407	92
1970	1252	416	400	99
1969	1284	412	371	98
1968	1239	371	339	99
1967	1211	354	333	104
1966	1242	364	337	108
1965	1145	326	298	84
1964	1104	305	264	81
1963	990	275	239	82

1. Source: Pulp Chemicals Assn. distilled tall oil data include acid-refined tall oil
2. Source: Chemical Economic Handbook, SRI International

SOURCES OF NAVAL STORES



Source: P&P, June 1979

- Oleic, linoleic, and conjugated linoleic acids produced from low-rosin TOFA via solvent crystallization and subsequent treatment
- TOFA amido amines for flotation.

ROSIN

Gum and wood rosin (naval stores rosin) are distilled from pine oleoresin—gum rosin from the sap of living trees, and wood rosin from the oleoresin extracted from dead stumps with solvents, then steam-distilled. Tall oil rosin is fractionated from crude tall oil.

The gum rosin and turpentine industry in the U.S. has practically vanished. The remaining activity is almost entirely in south Georgia. The U.S. is a net importer of both gum rosin and gum turpentine. Gross imports of gum turpentine during the April 1980-March 1981 crop season totaled 534,500 gal, a 49% increase from the previous season. Gross imports of gum rosin during the same period totaled 14.7 million lb,

PRODUCTION & VALUE OF U.S. BYPRODUCT CHEMICALS, 1980

Product	Unit	Production (millions of units)	Average price[7] ($/unit)	Annual value ($ million)
Naval stores:[1]				
Gum rosin	lb	12	0.35	4.2
Steam-distilled rosin	lb	230	0.30	69.0
Gum turpentine	gal	0.34	2.04	0.7
Steam-distilled turnpentine	gal	2.61	1.80	4.7
Pine oil[6]	gal	9.64	3.80	36.6
Other terpenes	gal	2.95	1.80	5.3
Subtotal			**120.5**	
Sulfate mill products:				
Crude tall oil	lb	1761	0.10	—[2]
Crude tall oil used as such or sold	lb	118	0.10	11.8
Distilled tall oil[3]	lb	109	0.24	26.2
Tall oil rosin	lb	448	0.24	107.5
Tall oil fatty acids	lb	407	0.25	101.8
Sulfate turpentine (refined)	gal	24.98	1.45	36.2
Pitch	lb	580[5]	0.05[5]	27.0
Sulfate lignin	lb	60[5]	0.07[5]	8.4
Dimethylsulfide	lb	18[5]	0.37	4.2
Dimethylsulfoxide	lb	2[5]	0.60[5]	1.2[5]
Subtotal			**326.3**	
Sulfite mill products:				
Lignosulfonate, Ca-base	lb	625	0.04	25.3
Lignosulfonate, Na-base	lb	99	0.17	16.9
Lignosulfonate, other[4]	lb	156	0.14	21.5
Lignosulfonate, total[4]	lb	881	0.07	—[2]
Ethanol, 190-proof	gal	5.5	1.83	10.1
Vanillin	lb	17	4.75	80.8
Torula food yeast, dry	lb	18	0.50	9.0
Acetic acid, glacial[8]	lb	8	0.24	1.9
Subtotal				**96.8**
Total all categories				**612.4**

1. Naval stores data are for crop year, April 1 to March 31
2. Value accounted for under other headings
3. Includes acid-refined tall oil
4. Includes lignosulfonates from sulfate lignin
5. Estimated
6. Includes pine oil made from sulfate turpentine
7. Carload or wholesale price, F.O.B. mill
8. Made from NSSC spent pulping liquor

down 30% from the previous season. In 1980, the total market value of U.S.-produced gum rosin and gum turpentine was only about $5 million;.

Only two U.S. companies, Hercules and Reichhold, still manufacture steam-distilled wood rosin and turpentine. The wood rosin business in the U.S. is based on the extraction of rosin and terpenes from aged pine stumps which are primarily from cuttings of the virgin forests of the Southeast. Aged pine stumps are required because they are high (20% to 25%) in extractable material. In recent years, these aged stumps have become more scarce, hence the decline in the wood naval stores industry.

Hercules recently has begun treating the root collars of relatively young trees with "Pinex" reagent (probably a herbicide such as paraquat) prior to harvesting. Studies have shown that the extractives content of stumps of trees cut two years after the treatment is significantly higher than untreated trees. Commerical application of the Pinex program was begun in the fall of 1979, and the first stumps will be harvested and processed in 1982.

The output of tall oil rosin exceeded that of naval stores rosin for the first time in 1972, and reached a level of 444 million lb (222,000 short tons) in 1981. The importance of tall oil rosin in relation to naval stores rosin produced in the U.S. is shown in the following table:

U.S. ROSIN OUTPUT BY TYPE

(% of total)

Type	1981	1977	1963
Gum rosin	1	4	22
Steam-distilled wood rosin	34	36	53
Tall oil rosin	65	60	25

Between 1963 and 1977, the share of tall oil rosin in total U.S. production increased from 25% to 60%, and by 1981 had risen another 5%. Tall oil will probably account for nearly 90% of all rosin output by 1990 unless the Pinex process causes a major resurgence in the wood rosin industry.

Rosin consumption in the U.S. declined an average of 3% per year between 1970 and 1980. Total U.S. consumption in 1970 was 760 million lb, compared with 554 million lb in 1980. Significant decreases in rosin used for sizing of paper and in rubber for manufacturing tires have led to this decline. Exports have also declined, by 3.9%/yr from 256 million lb in 1970 to 179 million lb in 1980.

Printing inks appear to be the major potential growth area for increased rosin use, in the form of variously modified rosin esters and in resinates. The following table is a breakdown of major uses of rosin in the U.S.:

MAJOR USES OF ROSIN IN U.S.

(% of total consumption)

Use	1980	1977
Rubber and chemicals	33.2	35.2
Paper sizing	33.1	33.5
Ester gums and synthetic resins	22.7	25.2
Paints, varnishes, lacquers	2.2	2.0
Other uses	6.7	6.5

Source: Pulp Chemicals Assn.

SULFATE TURPENTINE

While total turpentine production in the U.S. declined 22% between 1963 and 1981, the production of sulfate turpentine increased 24% in that period, and in 1981 accounted for 89% of U.S. turpentine production.

Sulfate turpentine is recovered from the condensate of kraft digester relief gases. Gum and wood turpentine are distilled in the same manner as naval stores rosin, turpentine being the volatile part of the gum, and rosin the nonvolatile residue.

Since 1963, the major use for turpentine changed from its traditional one as a solvent for oil-base paints, to its primary use as a raw material in the production of various chemicals. Major uses of turpentine in the U.S. are indicated below, expressed as percent of total turpentine output in 1981:

U.S. TURPENTINE OUTPUT

(% of total)

Type	1980	1977	1963
Gum turpentine	1	3	21
Steam-distilled wood turpentine	9	11	23
Refined sulfate turpentine	89	86	56

The major use of turpentine is currently in the synthesis of pine oil. More than 80% of the pine oil produced today is synthetic. The rest is "natural pine oil" obtained from fractionation of pine stumpwood extractives.

The increased demand for turpentine resulting from the development of new uses has made for a steady increase in price, further aggravated by a decrease in supply.

CANADIAN NAVAL STORES

Canada is a relatively small producer of naval stores at present. In 1980, Canadian crude tall oil (CTO) production totalled 84,000 tons, and Canadian sulfate turpentine production was 3.2 million gallons.

There are two distinct geographical regions in Canada producing naval stores; Western Canada, consisting of interior kraft mills in British Columbia and Alberta; and Eastern Canada, particularly mills in the lakehead region of Ontario. Of the 12 mills in the Western area with sulfate soap collection potential, only 8 mills were collecting soap in 1980, and only 2 were producing CTO. In Eastern Canada, 8 of 9 mills with collection potential are collecting soap, and 5 are producing CTO.

CTO recovery in 1980 averaged 44 lb/a.d. ton of pulp production at eastern mills and 35 lb/a.d. ton at western mills. The average CTO acid number is the east was 142, and the average in the west was 136. (Note: CTO acid number at mills in the U.S. South averages about 160.) The difference in CTO yield and quality between the two regions can be attributed to the varying species being pulped. Spruce is widely pulped in the west with pine, and gives very low CTO yields and quality (20 to 30 lb/a.d. ton yield, 143 calculated acid number). Also sawmill chips are extensively pulped in the west, which also leads to reduced byproducts yield. In the eastern mills, the average rosin and fatty acid composition of the tall oil are about equal, while western tall oil has an average fatty acid content about 13% greater than average rosin content.

Between 1979 and 1980, Canadian CTO production totals increased by nearly 13%. According to recent estimates, if all mills pulping soap-bearing wood chips were to implement soap collection at the present efficiency (estimated at 40%), CTO production would rise to 9[illegible],000 tpy by 1985. If soap collection efficiency were improved to an attainable 80%, CTO production

PRODUCTION OF ROSIN IN U.S. 1963-81

(million lb)

Year	Gum rosin	Steam distilled wood rosin	Tall oil rosin	Total rosin
1981	10	230	450	690
1980	12	230[1]	418	660
1979	14	232	464	710
1978	18	240	422	682
1977	26	251	406	678
1976	31	265	410	708
1975	37	186	342	565
1974	28	284	366	678
1973	39	342	443	824
1972	46	364	437	847
1971	48	381	419	848
1970	45	400	416	861
1969	61	432	412	905
1968	88	499	371	958
1978	116	502	354	972
1966	141	513	364	1018
1965	187	561	326	1074
1964	203	539	305	1047
1963	239	571	275	1085

1. Estimated

Production data for gum rosin and steam-distilled wood rosin refer to crop year, April 1 to March 31

Sources: Crop Reporting Board, USDA, Pulp Chemicals Assn.

PRODUCTION OF TURPENTINE IN U.S. 1963-81

(million gal)

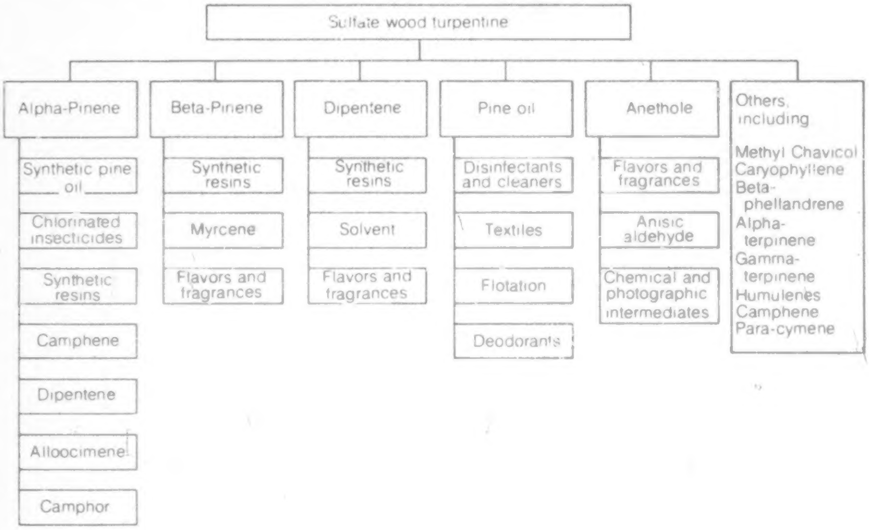
Year	Gum	Steam-distilled wood	Sulfate*	Total
1981	0.31	2.61e	23.31	26.2
1980	0.34	2.61	24.98	27.9
1979	0.37	2.44	23.45	26.3
1978	0.52	2.37	22.07	25.0
1977	0.73	2.62	20.30	23.6
1976	0.87	2.99	20.26	24.1
1975	1.03	2.07	19.27	22.4
1974	0.78	3.11	20.46	24.4
1973	1.07	3.44	22.02	26.5
1972	1.33	3.77	23.21	28.3
1971	1.42	4.27	22.75	28.4
1970	1.29	4.73	22.77	28.8
1969	1.75	5.14	23.98	30.9
1968	2.52	6.43	23.66	32.6
1967	3.39	7.02	20.99	31.4
1966	4.21	7.73	21.34	33.3
1965	5.57	8.43	21.03	35.0
1964	5.98	7.87	20.02	33.9
1963	7.03	7.87	18.78	33.7

* Data refer to refined sulfate turpentine, derived from crude turpentine data by multiplying by 0.8

e = estimated

Source: Crop Reporting Board, USDA, Pulp Chemicals Assn. Naval Stores Review, 1974 Yearbook

COMPONENTS OF SULFATE TURPENTINE AND MAJOR USES


Sulfate wood turpentine
Alpha-Pinene
Synthetic pine oil
Chlorinated insecticides
Synthetic resins
Camphene
Dipentene
Alloocimene
Camphor
Beta-Pinene
Synthetic resins
Myrcene
Flavors and fragrances
Dipentene
Synthetic resins
Solvent
Flavors and fragrances
Pine oil
Disinfectants and cleaners
Textiles
Flotation
Deodorants
Anethole
Flavors and fragrances
Anisic aldehyde
Chemical and photographic intermediates
Others, including
Methyl Chavicol
Caryophyllene
Beta-phellandrene
Alpha-terpinene
Gamma-terpinene
Humulenes
Camphene
Para-cymene

Source: Pulp Chemicals Assn.

could potentially reach 191,000 tpy. Thus, Canada remains the largest untapped source of tall oil in the western world.

Canada has only one operating CTO fractionation plant, a 19,000 tpy plant in Burlington, Ont., owned by Hercules Canada. In 1977, Canada exported 3700 ton of CTO to Japan and 37,000 ton to fractionation plants in the U.S. Exports increased in 1980 to 8300 ton to Japan and 41,900 ton to the U.S. Additionally, 30,700 ton of soap were shipped to the U.S. in 1980.

Soap shipments have since been discontinued because of prohibitively high transportation costs. Because Canadian CTO production exceeds domestic fractionation capacity by about 66,000 tpy, several companies have discussed building additional fractionation capacity there. However, it is likely that Canada will remain a net exporter of tall oil and an importer of refined tall oil products for several years.

In Western Canada 12 of 20 kraft mills with sulfate turpentine collection potential have collecting equipment in place, but only 8 of those mills are actively collecting turpentine.

In the east, 8 of 9 mills with collection potential are actively collecting turpentine. Turpentine yield in the east averaged 1.2 gal/a.d. ton in 1980, while average yield in the west was only 0.1 gal/a.d. ton. The low yield in the West is due to the predominant use of continuous digesters and sawmill chips for pulping.

The alpha-pinene and beta-pinene contents of the western turpentine from Western interior mills is high in beta-phellandrene, a compound used to impart the menthol flavor to cigarettes. If an economical means were found to separate and recover this compound, western turpentine recovery efforts would probably be greatly increased. Also, it is estimated that if all Canadian mills pulping turpentine bearing species and having turpentine collecton equipment were to collect turpentine, production would be increased to 4.1 million gallons.

OTHER SULFATE MILL PRODUCTS

Dimethyl sulfide is produced by treating black liquor with sulfur at high temperature and pressure. Crown Zellerbach Corp. is currently producing about 20 million lb/yr of dimethyl sulfide at its Bogalusa, La., mill. Some of the dimethyl sulfide is oxidized to dimethyl sulfoxide, which has shown great promise as an industrial solvent and for some medical preparations, since it can diffuse through human or animal skin with ease. Initial restrictions on its use imposed by the Food & Drug Administration (FDA) have now been removed. This should lead to many new applications for this versatile compound. Expansion of existing plant capacity may, however, be stifled by the fact that dimethyl sulfide can easily be made by the petrochemical industry from methanol and hydrogen sulfide.

Westvaco produces **alkali lignin** ("sulfate lignin") at its N. Charleston, S.C., mill by acidification of kraft black liquor. Sulfonation of this lignin yields a series of **lignosulfonates**. While these alkali lignin-derived lignosulfonates make up only a small percentage of total lignosulfonate production, they have shown themselves to be very competitive with lignosulfonates from sulfite mills, since the degree of sulfonation of the alkali lignin can be selected to fit the end use. These specialty compounds are used as dispersants, wetting agents, grinding aids, emulsifiers, coemulsifiers, stabilizers, antistripping agents, spray tank adjuvants, detergents, frothing aids, resin coreactants, sequestrants, air entraining agents, retarders, fiber processing aids, leveling agents, hydrotropes, and other intermediates. The output of alkali lignin in 1980 was estimated at 60 million lb, with a value of about $8 million.

The total annual value of sulfate mill products in 1980 was estimated at $326 million, or slightly more than half of the annual value of byproducts produced by the three major groups in the U.S. that year. These figures are somewhat misleading, since pine oil made from sulfate turpentine is included in the naval stores category.

LIGNOSULFONATES

Lignosulfonates are the main chemical byproduct of the sulfite pulping process. In 1980, the U.S. production of lignosulfonates amounted to 881 million lb, with a total value of $63.8 million. However, some of these lignosulfonates were made from sulfate lignin as explained above. The average 1980 value for lignosulfonate production was $140/ton, which includes unmodified, low-profit commodity grades of whole spent sulfite liquor evaporated to 50% to 95% solid and sold mainly as binders for applications such as animal feed pellet manufacture, zinc production, and concrete mixing.

The uses of lignosulfonate specialty products cover a wide range including emulsification, deflocculation, chelation, and adsorption. Probably the best prospects for growth (10%/yr) in this area are oilfield chemicals, which are largely Na-based specialties. Lignosulfate mud thinners and dispersants are widely used in deep oilwell drilling, and currently sell for around $300/ton.

Normally, only sulfite mills using ammonia or calcium bases produce lignosulfonates because magnesium and sodium-base mills find it more economical to recover spent liquors. In the U.S., American Can, Crown Zellerbach, Consolidated Papers, Flambeau Paper, Georgia Pacific, ITT-Rayonier, and Rhinelander Paper are producers of specialty lignosulfonates.

In Canada, Reed is the sole producer of specialty chemicals at its subsidiary, Lignosol Chemicals, Quebec

MAJOR TURPENTINE USES, 1981

(% of total)

Use	Percentage
Synthesis of pine oil	48
Manufacture of terpene resins	16
Chlorinated terpene insecticides	15
Flavors and fragrances	10
Others	11

U.S. SILVICHEMICAL PRODUCTION 1978-81

(millions of units)

	Unit	1981	1978
Naval stores			
Gum rosin	lb	10	18
Steam-distilled rosin	lb	230	240
Gum turpentine	gal	0.31	0.52
Steam-distilled turpentine	gal	2.61	2.37
Sulfate mill products			
Crude tall oil	lb	1761	1616
Crude tall oil, used as such or sold	lb	160	138
Distilled tall oil[1]	lb	109	115
Tall oil rosin	lb	444	422
Tall oil fatty acids	lb	407	388
Sulfate turpentine	gal	23.31	22.07

1. Includes acid-refined tall oil

Source: Pulp Chemicals Assn.

MAJOR USES OF TALL OIL FATTY ACIDS IN U.S.

(% of total consumption)

Use	1980	1971
Intermediate chemicals	49.1	36.8
Protective coatings	21.2	30.0
Soaps and detergents	7.1	13.3
Ore flotation	3.7	6.1
Misc.	18.9	13.8

Source: Pulp Chemicals Assn.

Rhinelander, Wis., and Boise Cascade, Salem, Ore., were producing the yeast. However, the Boise mill was closed in June 1982, leaving the Rhinelander mill as the sole U.S. producer of yeast from sulfite liquor, with a capacity of about 8 million lb/yr.

City, Que. Capacity of the Lignosol plant is currently being expanded from 110 to 240 million lb/yr.

OTHER SULFITE MILL PRODUCTS

Vanillin is formed by the alkaline oxidation of lignosulfonates in desugared spent sulfite liquor. Production and sales of vanillin have increased faster than those of any other silvichemical in the U.S. during the past 17 years. The market for vanillin is expanding, not only for use as a fragrance and flavoring agent, but also as a valuable raw material for the chemical and pharmaceutical industries. Vanillin is currently the preferred raw material for the manufacture of I-dopa, a drug widely used in treating Parkinson's disease.

Monsanto's plant at Seattle, Wash., is producing about 15 million lb of vanillin/year, valued at $71 million, f.o.b. mill, using only a fraction of the spent pulping liquor produced at Georgia-Pacific's mill at Bellingham. ITT-Rayonier brought a vanillin plant on-stream in 1979 at Hoquiam, Wash., with an initial capacity of 2 million lb/yr.

In Canada, Ontario Paper is producing 7 million lb/yr of vanillin at its 240-tpd, Na-based sulfite mill in Thorold, Ontario. As byproducts of this operation the mill also produces aceto vanillone, vanillil, and oxalid acid.

Torula yeast (Torulopis utilis or Candida utilis) is grown in the pentose and hexose sugars present in spent sulfite liquor. This pleasant-tasting food yeast can average over 50% protein, and contains B-complex vitamins as well as all essential amino acids and numerous minerals necessary to good nutrition. It is used as a food additive to boost nutritional value and flavor and as a substitute for more expensive protein sources.

Production of torula yeast reached a peak of about 18 million lb/yr in 1980. The product was priced at approximately $0.50/lb, f.o.b. mill, and annual sales revenue was about $75/ton of sulfite pulp from an average dry yeast yield of 150 lb/ton of pulp. At that time, two mills in the U.S., Rhinelander Paper Co.,

Ethyl alcohol, or ethanol, is obtained by fermenting the sugars in spent sulfite liquor. Only one company in the U.S. (Georgia-Pacific) is currently make ethanol; the Bellingham, Wash., mill yields approximately 5.5 million gal/yr of 190-proof alcohol, representing about 25 gal/ton of sulfite pulp. This alcohol is competitive in both quality and price with alcohol made from ethylene. Since there are presently 9 sulfite mills of similar capacity to the Bellingham mill operating in the U.S., they could together produce some 50 million gal/yr of 190-proof alcohol, if they followed the example of Georgia-Pacific.

Ontario Paper Co., Thorold, Ontario is currently producing 1 million gal/yr of ethanol from sulfite liquor, and is the only such producer in Canada.

Sonoco Products Co. is producing **acetic acid** at its NSSC pulp mill at Hartsville, S.C., by extracting the acidified spent pulping liquor with MEK (methyl ethyl ketone), which is then removed by distillation and recycled. Actually, both acetic and **formic acid** are obtained in this manner, but the latter is extracted with EDC (ethylene dichloride). Eight million lb of glacial acetic acid, worth about $1.9 million, are recovered annually. Formic acid is not sold at present.

The annual value of silvichemicals produced from spent sulfite liquors in the U.S. in 1980 is estimated at $166 million, or about 27% of the annual value of total U.S. byproduct production that year. This value may be low since it is based on unmodified lignosulfonates.

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ELECTRONIC COMPETITION

Paper is the most universal information-conveying medium in the world—popular because it is cheap, can do its job attractively and flexibly, and is highly portable. But for the first time in history, paper is vulnerable on all those grounds to competition from another information-conveyance system: the electron.

Worries about the future of paper in an electronic world probably go back to the founding of the first commercial radio station, of course. And despite such concerns—which got a new lease on life with the development of commercial television—consumption of printing/writing paper has risen steadily throughout this century.

Unfortunately for the paper industry, that does not mean the threat of electronic competition should not be taken seriously.

Consider a world in which offices can draw on centralized data bases hundreds of miles away for facts and figures; in which men and women—or, inadvertently, their children—can vote through the medium of their television set; in which shopping and banking can be done without leaving the four walls of the kitchen or family den; in which workers can even stay home and do their jobs without fighting for a seat on the commute train—that kind of world is not a figment of a science-fiction writer's imagination. It is here today.

And, more important for the paper industry, each of those tasks and many others which can be done electronically, or will be done electronically in the future, today require the use of paper.

White-collar workers. A study recently released by SRI International of Menlo Park, Calif., predicted that by the year 1990 there will be more computer terminals in American offices than there are electric typewriters today. The number of such terminals will jump by nearly 12 times, with the result that one out of every four white-collar workers will operate an electronic work station. Whether those terminals will consume less paper or possibly more than present-day typewriters is subject to intense debate, but the fact remains that they have the potential to accomplish a great deal of work entirely without paper.

The forecaster's crystal ball is clouded when attempting to guess how soon such electronic services will displace much paper, however. A wide variety of highly-paid consultants have come up with any number of conflicting estimates of how soon the paper industry will suffer from electronic competition, and how much. No one truly knows how readily North Americans—either as consumers or as workers—will switch from a white sheet of paper to a bright green screen.

Paper grades to watch. About all that can reasonably be done is to say which grades of paper are widely believed to be vulnerable to displacement, how much of them is consumed, and what experiments are being undertaken that could have an effect on paper demand.

A table in this report projects consumption or production of certain grades of paper—those that seem most vulnerable to the effects of the electronic media trend—out to 1985, based on recent historical trends and assuming no measurable impact from electronic competition in that period of time. A rough consensus of observers assumes there will be little impact on paper demand before 1985, so that year may serve as a useful baseline for comparing how much bigger the printing/writing paper industry can grow before it begins to bump against an electronic wall. But it is entirely possible that any measurable impact will be delayed until 1990 or beyond—or will occur before 1985, in the event of unexpected and revolutionary technological developments.

Each one of these paper industry sectors includes companies that have some already-outmoded capacity as well as some recently installed, highly efficient capacity. It seems clear that if and when a measurable impact on paper demand does occur, it will mean the death of some paper machines. Also, paper machines being installed today may find their economically useful lives shortened by the development of new electronic information services. Paper industry executives, therefore, are beginning to consider the electronic threat when they do long-term capacity planning in each of these sectors.

IMPACT ON NEWSPRINT

The paper grade that has gotten the most public scrutiny for its potential vulnerability is newsprint. Virtually every large newspaper chain in the nation has either joined in an experiment into delivery of news on the home video screen or has at least looked seriously at the economics and marketing of such a system.

Among the leaders have been Knight-Ridder, with the two-way Viewtron service it started with American Telephone & Telegraph in Coral Gables, Fla.; Times Mirror, with a two-way system it has tried out using Canadian "Telidon" technology, in Southern California; and Dow Jones, using France's Antiope system and employing home computers and cable television. One-way (teletext) services will soon be available by cable television, offered by Time Inc.'s HBO. These home information systems are not intended to be mutually compatible. And they represent just the tip of the iceberg of publisher experiments with electronic news delivery.

Indeed, one executive cited a 1981 American Paper Institute study that counted 83 home video information systems in operation around the world, ranging from Britain's one-way (non-interactive) Ceefax system, with an estimated 105,000 subscribers, to others with as few as 100 subscribers or less. Some involve broadcast through the air, while others depend on cable television lines and others employ telephone lines. Some require a special screen and others can be adapted to the viewer's television set.

Cable services. Most observers believe that until some standardization appears in delivery mechanism hardware and software—with decisions to be made requiring millions of dollars, or more, in capital investment—home services could remain purely experimental. A 1982 St. Regis Paper Co. corporate planning department report guessed that "Teletext will emerge initially in the mid-80s primarily as an added-value service through larger-channel cable services."

Mead Corp.'s Bob O'Hara, who as head of the paper company's Mead Data Central is a prominent marketer of electronic information services, notes that among the decisions to be made by those trying to sell electronic information to the home is the basic one of the delivery mechanism—"is it going to be roof antennas that will sell for $300 or $400? Is it going to be cable television? Is it going to be AT&T replacing twisted copper with fiber optics?"

Skeptics also question whether consumers will pay the freight for news services, if they have to buy the equipment for such a system as a separate purchase. Eventually it may be possible to buy a television set with the necessary equipment attached to it, and according to one projection, most television sets sold in America by the end of this decade will include a decoder for teletext (one-way) reception of alphanumeric (letters and numbers) information on the unused lines of the TV screen.

Book-sized screens. But even if the consumer could gain access to one-way teletext or even an interactive videotex system cheaply, there is widespread question about most people's willingness to spend long periods of time reading a bright, nonportable screen. Recent press accounts, however, indicate that Britain's Sinclair Research, along with Japan's Hitachi, Matsushita and Toshiba, have all developed book-sized televisions with liquid crystal screens, solving portability and brightness problems—and for prices reportedly below $200/set.

A California company called EECO Inc. may have also solved another major problem in terms of the commercial qualities of home information centers: poor graphics. Most observers agree that without top-quality graphic capabilities, teletext and videotex will be hard-pressed to compete with print and commercial TV in the advertising that could financially support home information services. And now EECO appears to have developed a system, called Pictureware, which broadcasts both text and picture—with a picture quality equal to that of a standard TV broadcast—using short, very fast bursts to transmit to the receiver's TV-video cassette recorder combination.

Electronic Yellow Pages. AT&T itself believes about 7% of all U.S. homes will have videotext capabilities by 1990, while San Jose, Calif.-based Strategic Inc.'s estimate is six times as high as AT&T's. On the other hand, the St. Regis report concluded "it is quite unlikely on any given day in the forseeable future, that more terminals will be turned on than newspapers read."

One possible obstacle to the spread of home information centers involves AT&T itself, and its studies into the possibility of a switch from paper directories to an "electronic Yellow Pages" service over time. Newspaper publishers have fought AT&T fiercely in Congress and want to limit the phone company to the role of a common carrier rather than a generator of interactive services or one-way advertising and information.

The publishers' major concern is that the phone company could move from a static electronic Yellow Pages into an active, constantly-updated electronic Yellow Pages which would, in effect, represent electronic classified advertising. If that happens, with the financial muscle of Ma Bell, the electronic Yellow Pages could put most newspapers out of business, publishers fear. With almost 85% of all newspaper ads being local in nature and with classified advertising representing about 30% of all newspaper ad revenues, that is a substantial worry for them.

Newsprint demand impact. If such a service ever develops, provided either by AT&T or by some other competitor—such as the newspaper industry—it would be relatively cheap to piggyback news services on top of the classified advertising, as well as display advertising

MAJOR GRADES OF PAPER THAT MAY BE AFFECTED BY ELECTRONIC COMPETITION: U.S. PRODUCTION

(000 short tons)

	1970	1975	1980	1985e
Newsprint[1]	12,200	11,400	14,400	16,500
Groundwood specialties				
Roto news[2]	270	225	250	315
Directory[3]	200	300	450	575
Catalog[3]	250	300	390	450
Groundwood forms	—[4]	75	230	360
Groundwood book	155	130	130	130
Uncoated free-sheet				
Forms bond	720	950	1,500	1,900
Envelope stock[5]	470	460	660	700
Offset book	1,400	1,450	2,000	2,400
Bond and writing	700	1,000	1,800	2,300
Tablet	350	230	325	300
Coated paper				
Nos. 1 to 4, two-side	950	1,200	1,800	2,200
No. 5, two-side	1,950	1,650	2,400	3,100

1. North American production
2. Estimated U.S. consumption: 1980—700,000 tons; 1985—900,000 tons. Estimates for 1970 and 1975 not considered reliable.
3. Numbers reflect estimated U.S. consumption, not production. Estimates for production not considered reliable.
4. Not applicable
5. Does not include uncoated free-sheet purchased by envelope makers without specific knowledge of mills, estimated at about 200,000 tpy.

Source: PULP & PAPER estimates

if quality graphics can be assured. At that point the traditional role of the newspaper in society would be threatened.

International Resources Development, a Norwalk, Conn., consulting firm, believes newsprint consumption in the U.S. will begin to level out in the late 1980s, while one newsprint executive cited another consultant's study that showed newsprint demand flattening out about 1990 and starting to fall around 1995. This executive's personal opinion is that consumption won't do more than level off in this century if AT&T's role in developing home video information services is severely limited by law—and will still take five to eight years to flatten out even if AT&T doesn't suffer from major legal limits.

Classified ad revenues. Any negative impact on newsprint demand at all seems to depend on a scenario in which classified advertising and some display advertising have flown to electronic services or are beginning to do so. At that point, those electronic services may also offer some news, possibly in the form of a headline service that refers the viewer for further details to a particular page of the printed newspaper.

The printed sheet, thus, ends up serving as a full-text retrieval system—assuming most viewers are not willing to undergo the punishment of having to read the entire morning paper on a bright green screen—while the quick scan over coffee, if that is what the viewer wants, takes place on the screen. Since many readers do little more than scan quickly any way, this may result in a significant drop in circulation, at least for municipalities large enough to be served by such an electronic system.

Entertainment format. The St. Regis report noted that "newspapers are both a vibrant and resilient medium, and their continuing evolution from a hard news to an interpretive and entertainment format will more than offset the ability of electronics to relay factual 'wire-copy' type reporting that is typical of most current systems."

If the viewer can call up on the screen all ads for used homes for sale, but cannot go beyond that, for example—in other words, if classified advertising but not directory information is available by screen—then the impact of electronic home information systems on paper will be largely restricted to newsprint, with few minor exceptions, most observers believe.

But if it is also possible for that viewer to ask the home information system to display the names and telephone numbers of all real estate agents handling homes in a particular town, for example—in effect, an electronic Yellow Pages service—then the directory paper of the uncoated groundwood industry will also be severely affected by such electronic services.

IMPACT ON UNCOATED GROUNDWOOD

These grades of paper have an even broader range of potential vulnerabilities from electronic competition than does newsprint, since uncoated groundwood paper goes into newspaper Sunday supplements, preprinted inserts, directories, catalogs, business forms, books and other important end-uses—all areas that could either suffer or benefit from the effects of the new technologies.

Directory paper seems likely to be hurt by competition from electronic media. Dun & Bradstreet, publisher of the *Official Airline Guide*—a major directory typical of the kind of focused information that might more efficiently, in theory, go into an electronic format than on paper—is believed to be intensely interested in an electronic version of its products. Such an electronic guide could be much more timely than paper directories, and could be kept more accurate since errors could be corrected when found instead of languishing (unbeknownst to readers) uncorrected until the next edition of a paper directory is issued.

AT&T directory paper use. But the major end-use for directory paper in North America, the telephone directory—representing at least 90% of all directory paper—will have the greatest impact on both papermakers and consumers when, or if, it "goes electronic." AT&T alone is believed to consume 350,000 tpy of the 450,000 to 500,000 tpy of directory paper used in North America each year. AT&T sets the standard and virtually sets the price for North American directory-grade paper. While a large-scale North American conversion to an electronic directory is not expected by most observers in this century, the French telephone company's plans to replace paper with electronics by 1995 will create the economies-of-scale needed to permit an inexpensive electronic Yellow and white pages, if the French system achieves its goal.

Such a development would virtually wipe out directory paper as a significant North American product, at least as far as domestic consumption is concerned. Whether it will ever come about, or will occur within this century, is highly speculative, but Bowater Corp.'s Dan Temple noted that "AT&T is the one company that has the financial muscle to make the kind of investment that is necessary to provide full videotext capabilities."

And if the French experiment proves successful, export markets could be narrowed as well, since other European countries are expected to follow Paris' lead in converting to the new technology. Once that happens, Europe will no longer be a potential market for North American capacity, and European mills that still produce directory paper will be eager to seek markets in the remainder of the world, in competition with the U.S. and Canadians.

Catalog paper market. Catalogs are another product that could just as easily appear on a screen as on paper, at least in theory. Sears Roebuck tested that theory in 1981 when it distributed videodisc catalogs to Washington, D.C.-area stores and 1000 homes equipped with videodisc units. Paper catalogs were also distributed. A Sears official told an American Paper Institute audience in late 1981 that it did not find customers quick to accept the system, and it predicted there will be a delay of six or seven years before much catalog paper is displaced by such systems. It did find that videodisc catalogs offered cost savings to the catalog company, however, which may suggest a rosier future for such electronic books in the future as the public becomes more acclimated to the new technology.

An interesting variation on the electronic catalog appeared in Tuxedo Park, N.Y., and Montvale, N.J., in a two-store chain called Catalogia. The idea behind the chain—which hopes to expand rapidly now that its franchise application has been accepted in most states—is that the consumer goes into a Catalogia story and the sales clerk uses a computerized catalog system to check on the availability of desired products in a range of catalogs. When the customer has made a choice from one of the catalogs, the store hands the customer's order on to whatever catalog house has won the customer's business. Paper books as well as electronic catalogs are used, but it is obviously only a short step from there to doing the same thing from a home computer.

Preprinted inserts. Aside from the catalog and directory, perhaps the most important areas of potential impact in the uncoated groundwood field lie in the everyday newspaper supplement and preprinted insert. U.S. demand for rotogravure newsprint ranges up to 700,000 tpy or more, while standard offset-grade uncoated groundwood—just a small step above standard newsprint—represents a market that may be be as large as 500,000 tpy. Sunday supplements are probably impervious to short-term impact, since they require extensive text and high-quality graphics. But should consumer preference for print media ever wane—for example, if a commercially feasible videodisc newspaper is ever introduced—wholesale shutdowns of uncoated groundwood paper mills would be possible.

In the meantime, publishers of both Sunday supplements and preprinted inserts appear to be choosing higher quality paper more than they are downgrading—implying a greater interest in graphics and appearance than previously.

It should be noted about advertising inserts that the

POTENTIAL APPLICATIONS OF TELETEXT AND VIDEOTEXT

	Teletext and videotext	**Videotext only**
Information retrieval	Current news, weather, sports and stock prices Encyclopedic and almanac type information General directories	Specialized directories Historical news, stock prices Specialized data bases
Transactions	Video shopping (telephone ordering)	Paying bills Transfering funds Video shopping (direct ordering)
Messaging	Community bulletin boards (local events) Classified ads (autos, jobs, homes, etc.)	Electronic mail
Computing		Programmed learning Software packages (statistical, graphics, financial, etc.)
Advertising	Complete availability of classified and display ad formats	Access to a marketer's data base of products

Source: St. Regis Paper Co.

primary advantage of such inserts is their ability to generate store floor traffic. For that, a mass-delivery insert is more cost-effective in most cases than targeted mailings. But should an electronic home information system with high-quality graphics and readability ever become widespread, insert marketers could gain the advantages of both a mass-market approach and, when desired, targetability, by switching to the electronic system. This possibility may begin to worry the groundwood industry in the 1990s.

Groundwood forms paper. Not all the news will be bad for uncoated groundwood mills, however. An estimated 300,000 tons of uncoated groundwood paper is consumed each year in the U.S. by users of forms paper, largely replacing free-sheet forms bond in the bottom end of the computer printout paper price range. That type of groundwood product has shown itself vulnerable to market share erosion in times of surplus free-sheet capacity—and resultant free-sheet discounting—but most experts still feel that through the mid-1980s groundwood forms paper will continue to grow at fairly close to the 16%/year pace of 1981.

Several major manufacturers and converters, including Abitibi-Price Inc., are interested in seeing a groundwood forms paper developed that would run successfully through high-speed copiers, and some experts feel such a product will be introduced within the 1982-83 period. If that should happen, groundwood forms paper could potentially capture a large share of the estimated 62% of all forms that are consumed by companies internally. Bowater's Temple pinpointed the 10% of the forms market that goes into archival storage as particularly vulnerable to displacement from present storage modes—which could mean either a shift to a less-expensive paper grade or, on the other hand, conversion to electronic storage.

Indeed, the possibility of storing information electronically for archival purposes, along with the developing trend towards forms printed on plain cut-size paper by the office computer, bypassing the need to buy customized forms for inventory, represent the major threat to the whole business forms market, as will be indicated below in the discussion of uncoated free-sheet vulnerability to electronic competition.

Book paper market. Some uncoated groundwood paper goes into book production, also, and some analysts feel the book industry may begin to lose a modest amount of market share to videodiscs late in this century. Some types of books, such as restaurant guides, may also be better suited to electronic distribution, which could affect both groundwood and free-sheet book paper demand. U.S. uncoated groundwood mills are estimated to have shipped about 105,000 tons of paper to book publishers in 1981, with perhaps another 205,000 tons having come in from Canada.

IMPACT ON UNCOATED FREE-SHEET

Most of the potential impact on uncoated free-sheet mills from electronic competition is expected to come in the office rather than the home, and the new technology should break into the office well before it makes a mark on the home.

In fact it is already possible to see some of the outlines of an electronic revolution in offices, which could reduce consumption or change usage patterns in forms bond, envelopes, office printing paper, copy paper and writing paper as well as book publishing paper. Indeed, the total 7.5 million tpy U.S. uncoated free-sheet industry is the biggest single sector of the U.S. paper industry that has to worry about competition from new information technologies.

Great Northern Nekoosa's Lloyd Chambers has described the revolution in office information management as a consequence of the "digitization of text," which means that more and more verbal information can be stored in the nonverbal innards of a computer rather than appearing on a piece of paper. This will not mean the appearance in this century of the much-ballyhooed "paperless office," but it does mean that companies will be looking hard for new, faster and cheaper ways of recording and transmitting information—which increasingly implies the use of computers and their related equipment.

Free-sheet forms. As the primary recorder and transmitter of transaction information, business forms are one of the biggest single product areas that may eventually be displaced by electronic technologies. American mills shipped an estimated 1.6 million tons of forms bond in 1981, along with another 300,000 tons of uncoated free-sheet grades such as offset paper supplied to business forms converters. A reasonable projection puts forms bond shipments alone at 1.9 million tons by 1985. Beyond that, however, many observers believe the growth in demand for customized business forms will be slowed by the spread of in-plant printing operations equipped with intelligent copiers that can design their own forms and print them on plain paper.

One paper industry consultant cited an API study which estimated that the number of high-speed intelligent computer printers (over 60 pages/minute capacity) installed in U.S. offices will jump by 266% between 1980 and 1985, and such printers were already estimated to constitute 17% of all computer printer capacity installed in the U.S. in 1980.

Manifold forms. Computer output microforms (COM) also threaten the forms industry, some analysts believe, since they have the capacity to record tabular material on microfilm or microfiche and "the ability to print computer output ten times faster than the fastest impact line printer while offering a cheaper medium than multi-copy forms," Bowater's Dan Temple noted. For companies depending on a heavy volume of record-storage, Temple added, "COM thus bypasses the use of large quantities of stock continuous computer forms."

Market research firm Predicasts Inc. believes both stock and custom forms will still show a dramatic increase in sales, jumping by 110% between 1980 and 1985, although it forecasts only a 42% jump in paper consumption by the total manifold forms market during that period. During that time it predicts stock forms will survive slightly better than custom forms, raising market share to 36% in 1985 from 33% in 1980, while custom forms' market share will drop to 64% from 67%.

Most observers feel that all kinds of forms will continue to show a healthy growth for many years to come, however, as an explosion of office computing capacity leads to a burgeoning of both electronic and paper records. As big a threat to forms paper consumption as development of fast and intelligent copiers and printers, perhaps, is the birth of data transmission systems using satellite technology which are made to be hooked in directly with office information systems.

A time may come in the not-too-distant future when an office worker wanting to tell the head office and several branch offices about a transaction, for example, will do so electronically—dispensing with paper forms completely or at best shipping a paper form to the head office only and none to the branch offices. Such a development could begin to put a ceiling on future growth of forms bond even with the current increase in the volume of information that needs storing.

Envelopes not secure. Envelopes ought to be secure from the onslaught of the computer and screen, since virtually everything that moves through the mails except packages must go in an envelope. And paper is doing well in its battle with one new technology: observers say the trend towards plastic envelopes has never really gotten off the ground, and most estimates place the likely plastic market share of the total envelope market at 5% or below by 1990.

But the 850,000-tpy envelope market is highly vulnerable to any erosion on the amount of mail that moves through the U.S. Postal Service and private mail services, and is particularly vulnerable to the growth of electronic funds transfer systems. Predicasts forecasts

SOME EARLY HOME AND OFFICE INFORMATION SYSTEMS

Name of system	Location	Nature of service
Antiope	France	Teletext (one-way home information net
AT&T experiments	Albany, N.Y.	Electronic phone directory, interactive, with headline news service (see also Viewtron)
Ceefax	U.K., Austria, Sweden, West Germany	Teletext news service, government sponsored
Comp-U-Serve	U.S.	Videotext news & financial information service, uses Radio Shack computers
Comp-U-Star	U.S.	Videotext (interactive) shop-at-home system
Dow Jones	U.S.	Videotext financial information service using cable television
Field Elect. Publish.	Chicago	Teletext system for news, classified display ads and public service announcements, using Britain's Ceefax technology
GTF Telenet	U.S.	A packet-switch network for businesses
HI-OVIS	Japan	Videotext system for news and messages using optical fiber cables
Lexis/Nexis	U.S.	Videotext services offered by Mead to provide legal and news data bases
OCLS	Ohio	Videotext service initially serving library market
Oracle	U.K.	Private teletext competitor to Ceefax
Prestel	U.K., Finland Holland, Switz., West Germany	Government-sponsored videotext news services
Project Green Thumb	Kentucky	U.S. government-sponsored experiment to provide weather and agricultural information by videotext
Qube	Ohio	Videotext cable information/entertainment net
The Source	U.S.	Videotext information net owned by Reader's Digest Inc.
Teletel	France	Government-sponsored videotext information net
Telidon	Canada	Government-sponsored videotext system with advanced graphic capabilities; AT&T has adopted a standard similar to Telidon
Time Inc.	U.S.	Uses teletext version of Canada's Telidon
Tymnet	U.S.	Videotext sdervice for home banking
Viewtron	Florida	Videotext news and classified advertising service, joint venture of AT&T and Knight-Ridder

that the number of pieces of mail per thousand dollars of real Gross National Product will drop from 71.6 in 1980 to 63.3 in 1990 and 59.8 in 1995. It also believes that the number of envelopes per piece of mail will drop from 1.01 in 1980 to 0.97 in 1990 and 0.96 in 1995, as more bills go out on continuous self-mailers, which require no envelope stuffing.

Electronic funds transfer. Initially, electronic mail will consist largely of financial information that is already coded numerically and can be formatted for convenient transmission. Electronic funds transfer (in which checking accounts are automatically debited to pay bills, for example) already take place in limited cases, and can be expected to become common in transactions between companies. Predicasts Inc. believes EFT transactions will comprise 20% of all retail sales alone by 1995, up from 2% in 1980.

Whether electronic mail ever spreads beyond EFT to an important extent will depend largely on the convenience and economy that businesses see in such systems. But early candidates for conversion to electronic mail will be inter-office memos and other intra-company communications.

Electronic mail hybrid. Some telex communication will also be displaced in the 1980s by computer terminal-to-terminal dialog, while bills may begin to migrate from traditional mail services to hybrid systems such as the Postal Service's experimental E-COM service (in which messages are transmitted electronically to a post office near the intended recipient, then printed on paper, stuffed in envelopes and physically delivered). Such hybrid systems will have little or no effect on paper consumption, but until many homes have computer terminals and telephone hookups (modems), that is about all that can be expected in the way of electronic mail into the home.

In the meantime, however, Americans and Europeans will be learning every day in the office what it is like to communicate with distant business contacts by electronic mail rather than by post office or telephone. A Predicasts study estimated that less than 16% of the 380 billion messages sent in the U.S. in 1980 went by first class mail, and this share is expected to fall to 11% by 1995, with telephone calls and electronic mail taking up the slack.

Companies such as AT&T are developing central switching services that will allow every kind of modem-equipped computer or word processor to communicate with every other modem-equipped computer or word processor despite the software and hardware differences on each end of the line.

Communicating word processors. European postal services have developed a system called teletex—different from the one-way news service called teletext—which offers a piece of hardware that hooks onto a computer or word processor to allow it to communicate with any other similarly equipped electronic unit.

Whether the American software-based electronic mail services or the European-style hardware approach becomes common, an increasing number of office workers will find it possible to type a message into a terminal on one end and be in almost instant communication with a typewriter or terminal on the other end. Whether the recipient demands hard copy from a typewriter or is satisfied with reading the message on a terminal, it means no envelope is needed at any point in the transaction.

Store-and-forward. Another form of electronic communication may have some minor effect on envelope demand, as well as on demand for telephone message pads: store-and-forward message services. Under such systems, a caller merely records a message on the recipient's store-and-forward device and has no reason to call again—while at present, a typical two-way phone conversation may take several tries before the caller finds the other party at his telephone. With a store-and-forward system, the recipient then gets the message from his message service when he is available. If such services, now in their infancy, ever become widely accepted, some workers may begin to rely on them in place of some paper-based mail.

One executive estimates that 350 of the Fortune 500 companies now have at least primitive electronic mail or message services or will very soon. He predicted that the current ratio in U.S. business of one terminal for every 20 desks is expected to increase to one for every three by 1990.

Another executive, however, pointed to a Univ. of Michigan study that indicates 59% of all first-class mail is involved in billing and payment, most of that moving from business to the home, and he believes that sort of mail will be slow to switch to the electronic form.

IMPACT ON BOND AND WRITING PAPER

When a switch to electronic mail begins—and as terminals become widespread in business for every other purpose—bond and writing paper will be affected as much as envelope paper. Reprographic paper, a 1.4-million-tpy market, can be expected to grow more rapidly than the overall printing/writing paper industry for a number of years—possibly for the balance of the century—as business forms are increasingly produced by intelligent copiers. And the current explosion of information-processing capability in the office is sure to contribute to a continued increase in the volume of office copying that takes place each day. This should be counterbalanced against a possible reduction in bond and writing paper use because of electronic mail, however.

Writing paper and tablet stock alike are vulnerable to competition from both electronic mail and store-and-forward message services. An American Paper Institute study also cited another threat, one consultant noted: electronic pads, in which a stylus or even a finger traces a design on the pad, which is in turn read and entered into memory by an attached computer, may enable computers to recognize handwritten text and also to pick up drawings and diagrams. This consultant noted that electronic pads will never be as fast as a keyboard for alphanumeric data, but may prove an important tool for designers, engineers and artists, and may also satisfy some executives and managers reluctant to learn the use of a traditional computer terminal.

Technical books. One advantage of an electronic pad is its portability, which may even be greater than that of the new portable terminals. But cheap, flat, portable display terminals are now in the works which may even convert some consumers away from books, some observers believe. One paper industry marketing manager notes that technical and special interest books represent 8% of the U.S. book publishing market. He also noted an API study that claimed a single videodisc can hold as many images as are contained in the entire Encyclopedia Brittanica, pointing out the threat of videodiscs to reference books.

IMPACT ON COATED PAPER

Videodiscs or a competitive flat, portable display screen—if one can be developed with less brightness than the traditional video display terminal—could impinge on sales of coated paper as well, if enough consumers could be convinced to get their weekly world news, gardening information and home decoration tips from a screen instead of the printed page. One executive estimated that coated groundwood demand may rise by only 2%/year in the 1990s, under competition from electronic media, in contrast with the 4%/year growth rate he forecasts for the 1980s.

Magazines like *National Geographic, Bon Appetit* or *Life* could be ideal for conversion into a video version, with an edition that combines screen text and moving and/or still pictures easy to imagine, he noted. More textually-oriented popular magazines like *Time* or the *New Yorker* are clearly better suited to remain on a print medium, he added. A number of magazines are also exploring cable television versions, another observer pointed out, which could represent an additional threat to coated paper demand.

Direct mail demand. Serious penetration of videodiscs or other screens into the home could also hurt coated free-sheet consumption by direct mail end-uses, once consumers are accustomed to sitting down in front of their screens to receive information.

Coated free-sheet consumption could also be affected by any trend towards videodisc display of corporate information such as that contained in annual reports, travel brochures or auto sales catalogs. International Paper Co. has pioneered both a cable TV and an audio-visual version of its annual report, and both travel and automobile companies are exploring videodisc display for material which previously would have been printed.

SHORT GLOSSARY FOR THE ELECTRONIC AGE

- **Cathode ray tube** (CRT). This is the most common kind of electronic screen, resembling a television screen and typically displaying bright green letters on a dark green background. Many people find a CRT difficult to read for prolonged periods of time (see LCD).
- **Computer output microforms** (COM). An off-line system encompassing both microfilm and microfiche, in which micrographic memory devices are accessed at extremely high speed by computer. This makes it possible to store large volumes of digital material, and then print it out as much as 10 times faster than the quickest impact line printer. COM is especially appealing to organizations with large-scale record storage needs, such as banks and insurance companies.
- **Decoder.** A decoder is a device that can be attached to a television set to enable alphanumeric (letters and numbers) material that is transmitted to unused lines of the television screen to be unscrambled and displayed on the screen. A decoder may also have a short-term memory capability, thus expanding the receiver's capacity for display and selection of material beyond the limited amount of material that is being broadcast at any one time.
- **Electronic funds transfer** (EFT). This implies the transfer of money through an accounting fiction, with the information passing from one party to another electronically. A typical application is the paying of bills, in which a bank checking account is automatically debited once a month to pay an insurance bill. An added capability of EFT systems may be speedy checking of credit.
- **Electronic mail.** Any nonverbal messages which travel electronically instead of moving on paper is electronic mail. In the currently limited state of the art, however, in which many intended recipients do not possess the capability to receive electronic messages—and in which much of the electronic hardware that is in place is not compatible with hardware owned by other persons or companies—a paper (hard-copy) message may be hand-delivered from an electronic mail center to the addressee. The Postal Service's new E-COM system is one such operation. Some companies are already experimenting, however, with hardware or software applications that would allow persons or firms with screens and modems (see modem) to communicate with each other, possibly paving the way for an eventual

national electronic mail system.

- **Electronic pad.** These experimental systems make use of two-dimensional sensors that can read up-down, side-to-side and diagonal motion of special styluses, or even fingers. It may even be possible for such a pad, with an appropriately programmed computer, to read handwriting. The pad converts the message from the sensor into digital form for communication to a computer. Possible applications include memo and note writing and graphic design.
- **Electronic Yellow Pages.** American Telephone & Telegraph has experimented with ways of distributing information by videotext (see videotext), including directory information, and reportedly would like eventually to develop a business directory which can be used entirely on a screen. Listings of company, by type and potentially by other kinds of classification—for example, a request might be made to the electronic Yellow Pages service to show all Exxon service stations in the Bronx offering tow-truck services—could be called up at the viewer's discretion under such a system. Electronic Yellow Pages in theory stops being a directory and starts being a classified ad listing when those listings begin to be updated often enough to reduce demand for classified ad services.
- **Liquid-crystal display** (LCD). An LCD is an alternative to a bright CRT-type screen, preferred by many because it is less painful for the eyes than a bright screen. A typical LCD such as that found in many quartz watches has a light gray background and dark gray or black letters. LCD terminals may also lend themselves better to flat displays—valued for portability—than CRTs do. One prototype LCD reportedly developed by Toshiba has a two-inch screen capable of producing five shades of gray.
- **Modem** (modulator-demodulator). A modem is a device for connecting a computer or word processor to a telephone system, by converting the electronic unit's messages into a form that can be transmitted over telephone lines.
- **Store-and-forward.** Such systems provide a kind of automatic switching service for telephone messages, eliminating the need for the caller to repeat calls in order to reach an intended recipient. A message is recorded by a store-and-forward mechanism, and the intended recipient then calls the mechanism regularly to request his messages, or is buzzed when he arrives in his office to notify him there are messages to be received.
- **Teletex** (no "t" at the end). This is a hardware idea being promoted by some European companies, including national post-and-telegraphic agencies, to allow computers and word processors to communicate with each other even though they have incompatible programming. The teletex hardware converts the language and other electronic formatting of any given computer system into a common electronic language that can be understood by other units that have teletex attachments. U.S. companies have generally explored a different approach, in which centralized switching services with software designed to translate between computers would do the conversion.
- **Teletext** ("t" at the end). This is the simplest form of home information service, "designed to provide one-way transmission of a selective amount of text and graphic information," in the words of a St. Regis Paper Co. report. Teletext can be delivered into the home on cable television lines or by broadcast, with only a limited amount of information—for example, 20,000 pages or frames—being available. Graphics on a traditional teletext display are extremely unsophisticated, resembling video games, but products are being developed to make use of the superior graphic capabilities of the television screen to marry high-quality still pictures with text.
- **Video display terminal** (VDT). This is a generic term, denoting any kind of computer or minicomputer terminal with a video screen. CRTs and LCDs are kinds of VDTs.
- **Videotext.** Videotext systems are interactive, which means that the user can both send messages to the system—requesting information from it, for example—and can receive messages or information. Since the availability of information, unlike teletext, is not limited to what is broadcast by a central broadcasting station in a given period of time, but can include everything in the memory banks of the videotext service, a theoretically unlimited amount of information can be requested. Telephone or cable television lines are used, and unlike teletext, a simple decoder is not adequate—a home computer is needed. A traditional color television is adequate for the screen, however. Also unlike teletext, videotext has the ability, because of its interactive nature, to permit the user to pay bills, shop, query specialized central data bases and directories, and in general act as a research tool for the user who is so motivated.

WORLD REVIEW

The promise of the early months of 1981 turned to disappointment as the year progressed. As in 1980, high U.S. interest rates slowed progress in the North American economy. The effects spread worldwide, bringing recession to nearly every industrial country and slowing down growth in even the most dynamic of the developing nations.

Pulp and paper suffered along with the rest of the world economy. Markets and prices weakened progressively as the year went on, and the slide speeded up in the early part of 1982, leading to the worst crash in pulp prices since the unfortunate events of 1976-77.

In 1981, output of paper and board worldwide rose by 0.3% to about 171 million metric tons*; while pulp production fell by 0.6% to about 131 million tons. It seems likely that real consumption for paper and board gained more than these figures would indicate but that destocking in the face of high interest rates reduced demand.

End-users of pulp, paper, and board ran down their stocks during the year as far as they could in a process that continued in 1982. In midyear, consumer inventories were quite low and any upturn was expected to have an immediate and substantial effect on demand.

Market pulp stocks at producer mills rose by a very large amount in the preceding year, however, and by the end of May 1982 stood at over 1.8 million metric tons in the Norscan group of countries; this is 700,000 tons more than 12 months earlier. Brazilian stocks were also believed to be much higher than a year ago.

Worldwide pulp, paper, and board capacity rose sharply in 1981. Paper and board capacity rose by at least 7 million metric tons to a little over 200 million tons. Pulp capacity went up by a little less to 154 million tons total.

The combination of stagnant or declining production and the sizable increase in capacity led to a significant slowdown in operating rates. For pulp and for paper/board, they fell to around 85% worldwide, a clear decline from 1980 levels.

Paper and board production. In North America, output rose by a million metric tons, and by a small amount in Africa and parts of Western and Eastern Europe. But in the European Economic Community (EEC), Asia, and Latin America there were declines from 1980 levels

Western Europe as a whole was one region where output fell last year. This was attributed entirely to a 300,000-ton decline in the EEC, which outbalanced small rises in Scandinavia and the rest of the region.

The main drop came in the U.K., which had suffered the closure of dozens of machines in 1980 and entered 1981 with capacity down by almost 20% from the previous year's level. But there were notable drops, too, in Italy and the Netherlands, both of which have had deep-reaching problems of their own.

Sweden also lost some ground, but the rest of Western Europe showed modest gains all around. In Eastern Europe, 1981 was not too bad and most countries registered good gains. The one exception was Poland, where the political upheavals led to a drop of 12%-13% in output.

Japanese production dropped by 1.1 million tons in 1981 and there was a small downturn in the Philippines. In every other major Asian country there were gains in 1981, though growth was not so rapid as usual. But the increases elsewhere were not nearly enough to compensate for the losses in Japan.

Total output was also down in Latin America, where Brazilian and Argentine production was off sharply, while Chile and Uruguay also lost some ground. There were moderate increases elsewhere, with Mexico leading the way; but, as in Asia, the rate of growth was lower than normal.

Very little accurate information is available on African production, largely because there is so little of it. South Africa, which makes about two-thirds of the continent's paper and board, enjoyed a good year with a

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** In this review, data from all countries, including the U.S., conform with FAO definitions. Thus, paper/board totals do not include insulation board; pulp figures exclude screenings, defibrated, and exploded pulps.*

strong upturn, but elsewhere little progress was reported.

Worldwide, the one paper grade to register a significant increase in output in 1981 was newsprint. A number of large new machines started up in 1980-81, notably in North America, and production rose by almost a million metric tons to 26.6 million tons. In North America alone, output was up by 800,000 metric tons.

In the case of printing/writing papers, the 1981 drop in production came despite installation of several large new machines in the last couple of years. This suggests that many smaller machines were closed down—which indeed appears to be the case, though it is not clear how many were for printing/writing grades.

In Western Europe alone, over 80 paper and board mills shut last year; at least 50 in EEC countries, 11 in Scandinavia, and roughly 20 in the rest of Western Europe. A further 70 shut down in North America. Elsewhere, figures indicate that another 50 or so are thought to have closed.

Pulp decline. Total world pulp production fell by over 800,000 metric tons in 1981, largely as a result of the serious deterioration in the Japanese industry and the somewhat less dramatic reduction in EEC output.

In Japan, production fell by nearly 1.3 million tons or almost 14% from 1980 levels, while in the EEC output dropped by a little over 400,000 tons or about 7%. North American output was up by half a million tons (less than 1%), and African by 150,000 tons (10%), while elsewhere there was relatively little change.

Output of mechanical pulp rose by half a million metric tons in 1981 compared to 1980. This was no doubt largely due to the worldwide increase in newsprint production. Output of chemical and other grades of pulp fell from the previous year's total, however.

Pulp production expressed as a percentage of paper and board production also declined in 1981, continuing a long-term trend. The percentage of pulp to paper and board produced in 1980 was 77.3%, but in 1981 it dropped to 76.6%.

The one significant upward movement in 1981 came in wastepaper consumption, which increased by 2.7% to over 49 million metric tons. Worldwide, wastepaper now represents nearly 29% of paper and board production. Some 5 million tons of wastepaper were traded.

The recession exerted strong downward pressure on the industry's capital investment programs. Announcements of major new projects were scarce throughout the world, and several programs which had seemed well underway back in 1980 suddenly appeared less likely to be realized.

The *PPI Projects Survey 1982-85*, published in mid-1982, reported a slower capacity growth for this three-year period than in earlier annual surveys. Estimates for the 1982-85 term are for 12.6 million annual metric tons worldwide of new paper and board capacity to be added by confirmed projects (orders actually placed) and 11.1 million annual tons of new pulp capacity. Projects in the advanced planning stage should add another 4.1 million tons of paper/board and 2.5 million tons of pulp, according to the *PPI* survey.

NORTH AMERICA

North American companies saw 1981 profits drop for the second year running, though weakness in the wood products sector had a worse effect than any decline in pulp and paper sales. Demand for wood products fell because of the poor state of the construction industry in North America.

Paper and board production in U.S. and Canada totaled 71.3 million metric tons in 1981, a rise of 1.5% from 1980. In the U.S. there were small output gains for almost all paper grades, but board production fell by 100,000 tons from the 1980 level. Canadian end-of-year figures showed declines of a similar size in

PRODUCTION BY CONTINENTS, WORLD TOTAL (000 metric tons)

	PULP				
	1960	**1970**	**1979**	**1980**	**1981**
North America	32,964	54,912	64,554	65,969	66,434
Europe	20,965	34,853	39869	40,235	39,983
Asia/Australasia	5,156	14,268	16,719	18,239	17,094
Latin America	821	2,224	4,766	5,848	5,789
Africa	124	900	1,369	1,502	1,652
World total	**60,031**	**107,157**	**127,277**	**131,793**	**130,952**

	PAPER AND PAPERBOARD				
	1960	**1970**	**1979**	**1980**	**1981**
North America	38,917	58,914	71,029	70,225	71,295
Europe	25,634	45,159	59,024	59,023	59,193
Asia/Australasia	7,861	20,621	30,774	31,962	31,186
Latin America	1,656	3,712	7,754	7,737	7,578
Africa	288	892	1,617	1,717	1,813
World total	**74,355**	**129,298**	**170,198**	**170,664**	**171,065**

printing/writing and linerboard production.

Unsurprisingly, the North Americans remain the top producers in the world. In 1981 their share of world output was 42% of total paper and board and 51% of pulp. Pulp production in 1981 was 0.7% higher than in 1980, at 66.4 million metric tons. However, the performance of Canadian and U.S. pulp mills differed. While Canadian production fell (due primarily to labor disputes) to 19.3 million tons, a drop of 3.4%, U.S. mills increased output by 2.5% to 47.2 million tons.

North American production of newsprint, which is the Canadian industry's most important export, increased by 6.5% in 1981 to reach a new record of 13.7 million metric tons—over 50% of the world's total output. Canada's exports to the U.S. were down nearly 1% at 6.06 million tons, while its overseas exports increased by 18.6% to 1.81 million tons. This could mark the beginning of a shift in Canadian newsprint exports, with greater concentration on overseas markets rather than with the U.S., now the major trading partner.

Linerboard exports from North America in 1981 dropped 23% to 2.6 million metric tons. This was due largely to weakening in shipments from U.S., which exports more than eight times as much liner as Canada. The American Paper Institute attributes the fall to such factors as Western Europe's recession (U.S. exports to that area were down more than 30%), the strength of the U.S. dollar, and the cut in imports by People's Republic of China (from the substantial quantity in 1980).

Market pulp sales. Weakening demand on the international pulp market throughout the second half of 1981 brought North American pulp exports down 6.7% to 9.9 million metric tons. The weakness continued in 1982.

Canadian exports to the U.S. in 1981 were down 5.6% to 3.24 million metric tons. North American overseas exports fell by 7% to 6.6 million tons. These figures tie in with the rise in market pulp inventories and downtime at some Canadian mills taken to reduce stock levels. Canada's market pulp production in 1981 was 6.6 million tons, a drop of 8.6%. This results in an annual operating rate of 88%—more than 10% below the 1980 rate.

EUROPE

Western Europe endured a difficult year in 1981, as economic growth slowed down almost to a stop, while unemployment continued to rise. In Eastern Europe, economic growth continued at reasonable levels but here, too, the worldwide recession did nothing to improve performance.

In most of Western Europe, governments maintained tight controls over spending in an attempt to keep inflation under control. The major exception was France, where the election of François Mitterrand's Socialist government led to reflationary policies

WORLD'S TOP 20 PRODUCING AND CONSUMING COUNTRIES

PAPER AND BOARD PRODUCTION (000 metric tons)			PULP PRODUCTION (000 metric tons)			PER CAPITA CONSUMPTION (lb/yr)		
	1981	1980		1981	1980		1981	1980
1. United States	57,765	56,836	1. United States	47,159	46,025	1. United States	590	600
2. Japan	16,980	18,083	2. Canada	19,275	19,944	2. Sweden	441	452
3. Canada	13,530	13,389	3. U.S.S.R.	9,060	8,950	3. Finland	437	357
4. U.S.S.R	8,955	8,732	4. Japan	8,612	9,788	4. Canada	434	474
5. Fed. Rep. Germany	7,795	7,580	5. Sweden	8,529	8,699	5. Switzerland	366	370
6. Finland	6,135	5,919	6. Finland	7,331	7,234	6. Denmark	359	359
7. Sweden	6,131	6,189	7. China	5,080	5,190	7. Fed. Rep. Germany	346	342
8. China	5,400	5,350	8. Brazil	3,500	3,507	8. Netherlands	340	342
9. France	5,148	5,151	9. Fed. Rep. Germany	2,021	1,995	9. Japan	315	337
10. Italy	4,844	4,935	10. France	1,715	1,829	10. Norway	311	309
11. United Kingdom	3,381	3,793	11. Norway	1,608	1,494	11. Belgium	311	304
12. Brazil	3,297	3,468	12. Spain	1,364	1,329	12. Australia	302	320
13. Spain	2,588	2,566	13. Austria	1,210	1,229	13. New Zealand	298	282
14. Mexico	1,950	1,895	14. New Zealand	1,160	1,147	14. United Kingdom	273	269
15. Korea, Republic of	1,783	1,693	15. South Africa	1,122	1,012	15. France	254	256
16. Netherlands	1,683	1,714	16. Italy	962	1,075	16. Austria	238	236
17. Austria	1,671	1,616	17. Portugal	895	865	17. Ireland	205	205
18. Taiwan	1,498	1,479	18. Czechoslovakia	880	855	18. Iceland	201	183
19. Australia	1,394	1,471	19. Romania	815	815	19. Italy	192	192
20. Norway	1,373	1,373	20. Chile	743	763	20. Israel	181	174

1980-81 WORLD PULP, PAPER, AND

	Population (1,000)	Number of mills		Capacity (1,000 m tons)		Per capita (lb)	P & B consumption		Pulp consumption		Production (1,000 m tons)			
		P & B	Pulp	P & B	Pulp		1980	1981	1980	1981	P & B 1980	P & B 1981	Pulp 1980	Pulp 1981
EUROPE														
Belgium	9.900	17	3	905	400	311	1.370	1.391	608	591	864	887	359	337
Denmark	5.150	6	3	318	133	359	832	842	152	165	253	268	120	117
France	54.000	172	28	5.500	2.000	254	6.220	6.231	3.309	3.212	5.151	5.148	1.829	1.715
Germany, Fed. Rep.	61.666	200	37	10.028	2.322	346	9.642	9.585	4.331	4.334	7.580	7.795	1.995	2.021
Greece	9.450	18	4	355	65	95	428	410	154	148	320	300	54	48
Ireland	3.200	2	0	70e	0	205	299	299	30	30	55	55e	19	19e
Italy	57.180	480	55	5.850	1.350	192	5.244	4.986	2.691	2.419	4.935	4.844	1.075	962
Netherlands	14.246	35	5	1.880	212	340	2.201	2.193	814	718	1.714	1.683	206	162
UK	55.950	117	3	3.900	180	273	6.837	6.781	1.869	1.696	3.793	3.381	286	140
EEC	**270,742**	**1,047**	**138**	**28,806**	**6,662**	**265**	**33,073**	**32,718**	**13,958**	**13,313**	**24,665**	**24,361**	**5,943**	**5,521**
Finland	4.800	46	52	7.025	8.510	437	1.167	1.342	5.331	5.682	5.919	6.135	7.234	7.331
Norway	4.093	23	27	1.650	1.945	311	497	522	1.329	1.453	1.373	1.373	1.494	1.608
Sweden	8.330	58	64	6.860	9.625	441	1.842	1.688	5.763	5.785	6.189	6.131	8.699	8.529
Scandinavia	**17,223**	**127**	**143**	**15,535**	**20,080**	**454**	**3,506**	**3,552**	**12,423**	**12,920**	**13,481**	**13,639**	**17,427**	**17,468**
Austria	7.508	36	22	1.911	1.356	238	838	827	1.155	1.149	1.616	1.671	1.229	1.210
Iceland	232	0	0	0	0	201	20	21	0	0	0	0	0	0
Malta	350	0	0	0	0	68	11	11	0	0	0	0	0	0
Portugal	9.905	108	8	650	1.000	112	452	501	461	464	535	569	865	895
Spain	37.500	212	35	3.108	1.652	154	2.669	2.631	1.416	1.423	2.566	2.588	1.329	1.364
Switzerland	6.370	29	5	1.030	320	366	1.064	1.060	551	549	914	920	285	296
Other W. Europe	**61,865**	**385**	**70**	**6,699**	**4,328**	**179**	**5,054**	**5,051**	**3,583**	**3,585**	**5,631**	**5,748**	**3,708**	**3,765**
Total W. Europe	**349,830**	**1,559**	**351**	**51,040**	**31,070**	**260**	**41,633**	**41,321**	**29,964**	**29,818**	**43,777**	**43,748**	**27,078**	**26,754**
Albania	2.750	4	4	10e	10e	11	14	14	8	8	8	8	8	8
Bulgaria	8.903	20	na	450	280	123	495	523	327	337	395	420	234	240
Czechoslovakia	15.450	49	24	1.282	1.031	165	1.176	1.160	932	977	1.208	1.225	853	880
German Dem. Rep.	16.740	21	19	1.250	700	179	1.378	1.350	826	791	1.237	1.248	686	679
Hungary	10.700	10	6	na	na	141	632	383	294	288	440	457	111	112
Poland	36.100	53	26	1.436	934	75	1.426	1.217	999	864	1.277	1.118	821	711
Romania	22.000	20	11	870	850	71	684	684	849	849	805	805	815	815
USSR	268.800	84	56	10.000	9.450	73	8.731	8.905	8.127	8.115	8.732	8.955	8.950	9.060
Yugoslavia	22.354	30	21	1.275	750	115	1.106	1.169	821	838	1.144	1.199	679	724
E. Europe	**403,797**	**291**	**167**	**16,573**	**14,005**	**84**	**15,642**	**15,405**	**13,183**	**13,067**	**15,246**	**15,435**	**13,157**	**13,229**
Total Europe	**753,627**	**1,850**	**518**	**67,613**	**45,075**	**166**	**57,275**	**56,726**	**43,147**	**42,885**	**59,023**	**59,203**	**40,235**	**39,983**
NORTH AMERICA														
Canada	24.200	112	36	15.600	23.100	434	4.549	4.763	12.895	12.821	13.389	13.530	19.944	19.275
USA	229.700	612	248	66.007	52.980	591	60.550	61.590	46.248	47.529	56.836	57.765	46.025	47.159
North America	**253,900**	**724**	**284**	**81,607**	**76,080**	**578**	**65,099**	**66,353**	**59,143**	**60,350**	**70,225**	**71,295**	**65,969**	**66,434**
ASIA														
Afghanistan	15.800	0	0	0	0	0	5F	5e	0	0	0	0	0	0
Bangladesh	91.000	7	8	163	152	2	66	75	79	66	76	70	72	60
Bhutan	1.300	0	0	0	0	—	na	na	0	0	0	0	0	0
Burma	33.590	4	2	na	na	2	35	35e	17	17e	10	10e	17	17
Cambodia	8.870F	0	0	0	0	2	6F	6e	0	0	0	0	0	0
China, People's Rep.	988.000	1.600	na	6.300	5.600	13	5.882	5.208e	5.606	5.080e	5.350	5.400	5.190	5.080
Cyprus	630	0	0	0	0	174	50	50e	0	0	0	0	0	0
Hong Kong	5.200	2	0	30	0	265	600	623	1	0	12	23	0	0
India	660.000	159	264	1.816	1.500	4	1.488	1.523	0	0	1.088	1.148	na	na
Indonesia	147.000	31	14	370	1	9	513	546	81	171	232	250	81	81
Iran	40.000	17	2	330	260	31	608	540	75	150	111	129	75	100
Iraq	13.080	2	2	144	90	20	115	na	41	41	57	0	26	21e
Israel	3.976	5	0	155	na	181	315	326	60	65	126	137	0	0
Japan	117.890	593	68	22.473	12.788	315	17.926	16.795	11.904	10.206	18.088	16.980	9.788	8.612
Jordan	2.500	1	0	8	0	44	28	35	0	0	0	6	0	0
Korea, People's Rep.	19.000	6	2	100e	20	11	88	88	45	45e	80e	80e	45e	45e
Korea, Rep. of	38.723	170	5	2.180	314	93	1.561	1.640	654	742	1.693	1.783	186	222
Kuwait	1.370	0	0	0	0	84	52F	52e	0	0	0	0	0	0
Laos	3.770	0	0	0	0	—	1F	1e	0	0	0	0	0	0
Lebanon	3.160	3	0	20e	0	53	76F	76e	0	0	12	12e	0	0
Malaysia	13.923	12	na	100	na	71	445	445	4	4e	75	75e	na	na
Mongolia	1.670	0	0	0	0	11	8F	8e	0	0	0	0	0	0
Nepal	14.608	1	1	2F	2e	2	10	10e	2	2e	2F	2e	2	2e
Pakistan	82.500	17	17	120	95	4	171	212	63	102	89	102	55	90
Philippines	49.150	18	10	483	256	20	457	441	223	179	334	325	171	154
Saudi Arabia	9.292	0	0	0	0	24	102F	102e	0	0	0	0	0	0
Singapore	2.443	3	0	na	na	148	140	164	4.469	3.109	na	na	0	0
Sri Lanka	14.800	1	2	38	25	9	50	63	16	19	21	24	12	12
Syria	8.980	3	0	64	0	20	82	82e	0	0	3	3e	0	0
Taiwan	18.100	160	3	1.900	450	172	1.412	1.403	304	335	1.479	1.498	276	350
Thailand	47.875	34	7	456	150	24	471	527	145	169	355	394	63	69
Turkey	46.000	13	12	716	548	29	523	570	337	323	470	514	287	319
United Arab Emirates	900	0	0	0	0	—	na	na	0	0	0	0	0	0
Vietnam	52.300	55e	50e	147	107	2	45	53	33	36	45e	53e	33e	36e
Yemen Arab. Rep.	5.393	0	0	0	0	—	na	na	0	0	0	0	0	0
Yemen Dem. Rep.	1.863	0	0	0	0	2	2F	2e	0	0	0	0	0	0
Asia	**2,564,656**	**2,917**	**470**	**38,117**	**22,358**	**26**	**33,364**	**31,737**	**24,159**	**20,861**	**29,808**	**29,024**	**16,379**	**15,270**

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na = not available e = estimate F = FAO estimate

BOARD INDUSTRY AT A GLANCE

	Population (1,000)	Number of mills		Capacity (1,000 m tons)		Per capita (lb)	P & B consumption		Pulp consumption		Production (1,000 m tons) P & B		Pulp	
		P & B	Pulp	P & B	Pulp		1980	1981	1980	1981	1980	1981	1980	1981
AUSTRALASIA														
Australia	14,900	17	16	1,730	875e	302	2,099	2,045	987	911	1,471	1,494	713	659
Fiji	634	0	0	0	0	29	9	9e	0	0	0	0	0	0
New Zealand	3,195	5	6	798	1,385	298	399	416	683	652	683	711	1,147	1,160
Papua New Guinea	3,600	0	0	0	0	4	6	6e	0	0	0	0	0	0
Samoa	160	0	0	0	0	na	na	na	0	0	0	0	0	0
Australasia	**22,489**	**22**	**22**	**2,528**	**2,260**	**243**	**513**	**2,476**	**1,870**	**1,563**	**2,154**	**2,105**	**1,860**	**1,819**
LATIN AMERICA														
Argentina	28,138	89	16	1,013	589	66	933	848	464	427	705	656	338	299
Bahamas	240	0	0	0	0	9	1F	1e	0	0	0	0	0	0
Barbados	279	0	0	0	0	40	5	5e	0	0	0	0	0	0
Belize	160	0	0	0	0	22	16	16e	0	0	0	0	0	0
Bolivia	5,600	2	0	na	0	7	19	19e	0	0	1F	1e	0	0
Brazil	122,000	160	48	4,000	3,900	64	3,496	3,233	2,798	2,762	3,468	3,297	3,507	3,500
Chile	11,390	18	7	379	813	55	299	325	327	359	327	320	763	743
Colombia	28,000	26	7	509	246	37	441	452	238	254	367	369	206	204
Costa Rica	2,307	2	1	15	5	110	26	22	10	7	13	12	5	5
Cuba	10,000	9	3	150	60	46	214	214	83	83	97e	97e	45e	45e
Dominican Republic	5,551	2	0	45e	0	13	36	36e	4	4e	9F	9e	0	0
Ecuador	8,350	9	5	60	30	24	94	94	44	44	54	54e	24	24e
El Salvador	4,810	3	0	40	na	33	64	43	0	0	20	20	0	0
Guatemala	75,000	3	0	48	na	40	89	93	25	30	45	48	0	0
Guyana	832	0	0	0	0	18	7F	7e	0	0	0	0	0	0
Haiti	5,740	0	0	0	0	2	6F	6e	0	0	0	0	0	0
Honduras	3,670	0	0	0	0	33	54F	54e	0	0	0	0	0	0
Jamaica	2,215	1	0	6e	0	55	39	39e	0	0	1F	1e	0	0
Mexico	70,000	60	27	2,556	993	79	2,430	2,519	939	865	1,895	1,950	731	743
Neth. Antilles	247	0	0	0	0	26	3F	3e	0	0	0	0	0	0
Nicaragua	2,500	0	0	0	0	26	36	30e	0	0	0	0	0	0
Panama	2,000	3	0	20	na	88	83	78	0	0	18	18	0	0
Paraguay	3,117	2	0	na	0	11	17F	17e	0	0	1F	1e	0	0
Peru	17,780	13	4	na	na	22	172	176	171	171	159e	153e	140e	140e
Surinam	355	0	0	0	0	84	13F	14e	0	0	0	0	0	0
Trinidad & Tobago	1,150	0	0	0	0	66	34F	34e	0	0	0	0	0	0
Uruguay	2,900	12	5	70	28	55	76	71	35	30	64	51	25	23
Venezuela	16,459	14	3	706	160	99	747	764	380	380	501	518e	63	63e
Latin America	**297,203**	**425**	**126**	**9,617**	**6,764**	**55**	**9,427**	**9,236**	**5,520**	**5,418**	**7,747**	**7,588**	**5,848**	**5,789**
AFRICA														
Algeria	19,700	5	3	133e	99e	18	162	162	57	57	77F	77e	24F	24e
Angola	7,080	3	1	40e	44e	9	28	28	35	35	14F	14e	35F	35e
Benin	3,570	0	0	0	0	2	3	3e	0	0	0	0	0	0
Botswana	820	0	0	0	0	—	na	na	0	0	0	0	0	0
Burundi	4,510	0	0	0	0	—	na	na	0	0	0	0	0	0
Cameroon	8,400	0	1	0	120	7	27	27	0	0	5F	5e	120	120e
Central African Rep	2,284	0	0	0	0	—	na	na	0	0	0	0	0	0
Chad	4,508	0	0	0	0	—	na	na	0	0	0	0	0	0
Congo	1,540	0	0	0	0	2	1F	1e	0	0	0	0	0	0
Egypt	41,300	12	3	186	73	15	315	321	0	39	137	137	na	39
Ethiopia	32,600	2	na	10e	na	—	12	5	4	4	7F	4e	4F	4e
Gabon	565	0	0	0	0	4	1F	1e	0	0	0	0	0	0
Gambia	600	0	0	0	0	—	na	na	0	0	0	0	0	0
Ghana	11,742	0	0	0	0	2	8F	8e	0	0	0	0	0	0
Guinea	5,300	0	0	0	0	—	na	na	0	0	0	0	0	0
Ivory Coast	7,970	0	0	0	0	9	33F	33e	0	0	0	0	0	0
Kenya	16,400	1	1	55e	45e	9	65	65	15	15	48F	48e	15F	15e
Lesotho	1,340	0	0	0	0	—	na	na	0	0	0	0	0	0
Liberia	1,860	0	0	0	0	4	4e	4e	0	0	0	0	0	0
Libya	2,980	2	0	10e	na	11	14	14	0	0	5F	5e	0	0
Madagascar	9,000	1	1	30	5	2	12	11	0	4	9	8	na	4
Malawi	6,173	0	0	0	0	4	16	11e	0	0	0	0	0	0
Mali	6,910	0	0	0	0	—	1F	1e	0	0	0	0	0	0
Mauritania	1,630	0	0	0	0	—	na	na	0	0	0	0	0	0
Mauritius	960	0	0	0	0	11	5F	5e	0	0	0	0	0	0
Morocco	20,400	8	1	120	100	18	175	161	43	50	101	99	83	81
Mozambique	10,470	2	0	10e	na	4	19	19	0	0	2F	2e	0	0
Niger	5,346	0	0	0	0	—	na	na	0	0	0	0	0	0
Nigeria	85,000	3	3	14e	na	4	141	141	10	10	14e	14e	na	na
Rwanda	5,050	0	0	0	0	—	na	na	0	0	0	0	0	0
Senegal	5,660	0	0	0	0	4	17F	17e	0	0	0	0	0	0
Sierra Leone	3,470	0	0	0	0	—	na	na	0	0	0	0	0	0
Somalia	3,650	0	0	0	0	4	7F	7e	0	0	0	0	0	0
South Africa	29,360	16	10	1,321	1,193	99	1,314	1,368	840	944	1,200	1,288	1,012	1,122
Sudan	18,300	3	0	na	0	2	12	12	3	3	2F	2e	0	0
Swaziland	520	1	1	0	175	4	1	1	6	2	na	na	162	159
Tanzania	17,400	1	0	4e	na	2	23	23	0	0	3e	3e	0	0
Togo	2,563	0	0	0	0	—	1	1e	0	0	0	0	0	0
Tunisia	6,300	4	1	35	24	22	58	64	19	27	32	34	20	22
Uganda	13,225	1	0	2e	na	—	5	5	0	0	1F	1e	0	0
Upper Volta	6,910	0	0	0	0	—	1	1e	0	0	0	0	0	0
Zaire	28,090	1	0	2e	na	—	8	8	0	0	2F	2e	0	0
Zambia	6,052	1	1	16	14	7	17	16	0	0	0	16	na	na
Zimbabwe	7,480	2	2	na	na	18	58	58	32	32	58	58e	27	27e
Africa	**483,881**	**69**	**29**	**1,988**	**1,837**	**11**	**2,559**	**2,597**	**1,064**	**1,222**	**1,717**	**1,813**	**1,502**	**1,652**
WORLD TOTAL	**4,376,256**	**5,985**	**1,427**	**201,470**	**154,434**	[illegible]	**170,237**	**169,125**	**134,703**	**132,269**	**170,674**	**171,108**	**131,753**	**130,947**

designed to create demand and jobs.

The paper industry's progress faithfully reflected the rest of the economy. Total Western European paper and board production fell by 19,000 metric tons, to 47.7 million tons, while pulp output declined by a little over 300,000 tons to 27.7 million tons.

The key event of the year as far as the paper industry was concerned was undoubtedly the rise of the U.S. dollar on international money markets. Its value increased dramatically against every European currency, swinging the pendulum back in favor of the integrated paper and board producer.

In 1982 the dollar has strengthened still further, squeezing U.S. suppliers of pulp and kraftliner out of their traditional strongholds. Indeed, prices expressed in dollars fell so low by mid-1982 that North Americans were said to be selling marginal quantities of some products at below cost.

Estimates of production costs for chemical pulp in North America and Scandinavia show that the very considerable advantage the Americans used to enjoy has now disappeared. Wood costs are still lower in North America but cheaper energy and labor in Sweden outweigh more expensive raw materials.

The strength of the dollar has hurt nonintegrated paper producers in the European Economic Community as well as North American suppliers. Despite the drop in apparent pulp prices to a mid-1982 level of $500 less discounts for bleached softwood kraft, the price in local currency may have risen by up to 30% since 1980.

And most producers throughout Western Europe are unhappy with their profits. Even in Sweden, whose currency has dropped by 38% against the dollar since 1980, most producers do not seem to expect significant profits in 1982.

The decline in European paper and board production in 1981 was mainly concentrated in the EEC. Output fell by over 300,000 metric tons, to 24.3 million tons—the second successive annual decline. Imports from non-EEC countries rose by 4% to 9.6 million tons, while exports went up by 4.7% to 1.1 million tons. Apparent consumption thus fell very slightly to 32.5 million tons.

The drop in output was not equally spread over all the ten member EEC states. In Fed. Rep. Germany, production rose by some 200,000 metric tons to just under 8 million tons, a new record. In Belgium and Denmark, too, there were moderate increases.

The remaining producing countries reported lower production than in 1980, though for some of them the change was statistically negligible. Two countries accounted for most of the drop: in the U.K., output fell by 400,000 metric tons, to 3.4 million tons; and in Italy, by 100,000 tons, to 4.8 million tons.

Mills continued to close, including some quite large ones, though at a somewhat slower pace than in 1980. Still, over 50 paper and board mills shut down in 1981, leaving 1045 mills at the end of the year. The closures included about 20 mills in Italy and 18 in U.K., with fewer mills in France, Belgium, Holland and Germany.

Despite the closures, total annual capacity remained about the same, at 28.7 million metric tons. Thus the average mill size increased from 26,000 to 27,500 tpy. Excluding Italy (which has nearly half the EEC's mills, many of them very small), the average mill size is now just over 40,000 tpy.

Pulp production and capacity in EEC also continued to drop during 1981. Production fell by over 7% to 5.5 million metric tons, with capacity reduced by a little over 300,000 tons to 6.7 million tons. Operating rates therefore were only 82%, slightly below the world average despite the very small amount of market output involved.

Over 20 pulp mills also shut down during the year, 15 of them in Italy. The average size of EEC pulp mills thus increased from 44,000 to 48,000 metric tpy.

In Scandinavia, 1981 was a better year—though far from satisfactory. Finnish pulp, paper, and board production rose by a reasonable margin, but there were substantial declines in Sweden. In Norway, paper/board output remained at the 1980 level while pulp production rose sharply (largely thanks to increased tonnage coming from the new Tofte mill).

In the rest of Western Europe, paper and board production rose by about 100,000 metric tons to 5.7 million tons, while pulp output went up by a small margin to 3.8 million tons. Still, weak demand affected the industry in those countries and few, if any, companies made satisfactory profits.

In Eastern Europe as a whole, paper and board production rose by nearly 200,000 metric tons in 1981, to 15.4 million tons, while pulp output went up almost 100,000 tons, to 13.2 million tons. If Poland's results are excluded, the upturn was a good deal more impressive.

ASIA/AUSTRALASIA

Total Asian paper and board output in 1981 was just under 29 million metric tons, 2.5% down from 1980 and the first fall in production for many years. Australasia fared little better, with output dropping 2.3% to 2.11 million tons.

The reason for the decline in Asia was performance of the Japanese industry. Weak domestic demand and signs of a drop in exports forced Japanese manufacturers to cut back production and link it very closely to shipments. As a result, output was down by around 1 million metric tons, or 6.1%, for a total of 17 million tons.

Japan was the only one of Asia's big five producing nations to see a drop in production. Chinese output increased marginally (0.9%) to 5.4 million metric tons; Republic of Korea increased its paper/board output by 5.3% to 1.78 million tons; Taiwan's production went up by 1.3% to nearly 1.5 million tons; India's output was 1.15 million tons, up 5.5%. These five countries account for over 90% of total Asian production (excluding U.S.S.R.).

This is the first time since 1975 that annual production has been less than in the previous year. It also clearly shows the dominating position of Japan, which despite capacity cutbacks still made 57% of Asia's total paper/board in 1981.

Strict measures to cut overcapacity and hold production to demand are expected to be followed for most of 1982 by the Japanese industry, whose actions also affect others in the region—particularly those relying on pulp and woodchip exports to Japan.

Three of the other big Asian producers—India, Taiwan and Korea—managed to raise production over the 1980 level, even though affected by similar problems, such as rising raw material and energy costs, and weak paper prices.

In People's Republic of China, paper/board capacity is expected to expand steadily and slowly, but demand exceeds production by so much that imports of paper and board will continue. The country's fiber shortage is also likely to require continuing pulp imports. Imports from U.S. in 1981 were 157,000 metric tons, up by 12.8%. China also purchased 40% of Chile's exports of unbleached kraft pulp in 1981, rising to second place in Chile's list of top buyers of forest products.

Pulp production in Asia in 1981 was also down from 1980, dropping by 6.8% to 15.2 million metric tons. Imports fell by 26.8% to 6.16 million tons. Once again, the Japanese market effectively determined the overall size of the drop.

Australasia. This "Down Under" region (which effectively means Australia and New Zealand) experienced an economic pattern in 1981 similar to that in other areas. A good start faded away as 1981 progressed and the worldwide recession began to make itself felt on exports, particularly on chip exports to the Japanese and Southeast Asian markets.

In 1981 Australia and New Zealand also experienced a drop in pulp production of 2.2% to 1.82 million metric tons. However, the two countries pushed pulp exports up slightly and imports fell by a similar amount.

In New Zealand, pulp, paper, and board output reached record levels in 1981, due primarily to strong demand but also helped by lack of labor disputes. Early in 1982, a violent windstorm flattened an estimated 3 million cubic meters of timber in New Zealand's North Island and this is likely to have an impact on the country's wood reserves for several years.

Australian mills were affected more severely by Asian competition and some strikes. Overall production was down about 5% from 1980.

LATIN AMERICA

Paper and pulp output in 1981 fell just below 1980 levels, ending the climb of recent years and marking a period of negligible economic growth, rocketing inflation, and political instability for many Latin American countries.

1981 was also a year in which negotiations began for the sale of one of the most daring pulp mill projects, Jari Florestal in Brazil. It was eventually bought by a consortium of 20 Brazilian companies, none with pulp or paper interests, so ending the 15-year involvement of American entrepreneur Daniel Ludwig.

Some other major international projects were either shelved or cancelled—such as the decision by Japanese partners to give up on the Flonibra project, also in Brazil, which was supposed to eventually produce 600,000 tpy of bleached pulp from eucalyptus.

Total paper and board output in 1981 was 7.57 million metric tons, down 2.1%. The cause of the fall was the drop in Brazil's production—by far the largest producer—to 3.3 million tons, 160,000 tons below 1980. The other major producer, Mexico, bettered its 1980 output by 2.9% to 1.95 million tons. Of the other two countries producing more than 500,000 tpy, Argentina was 50,000 tons down on 1980 but Venezuelan mills marginally improved output to 518,000 tons.

Total annual paper/board capacity for Latin American countries is estimated at 9.57 million tons, from some 420 mills.

Latin American paper/board imports in 1981 were 1.82 million metric tons (same as 1980), while exports of 448,000 tons were up 20.8%.

Pulp output in 1981 was 5.79 million metric tons, down 1% from 1980. Brazil, however, maintained pulp production at the 1980 level at 3.5 million tons; and Mexico's output was up slightly at 740,000 tons. Production drops in Argentina and Chile were the main cause of the overall decrease. Chemical pulp output in Latin America in 1981 was down 1.3% at 4.29 million tons.

The continent's pulp trade balance improved by 13% even though both imports (770,000 metric tons) and exports (1.15 million tons) were lower than in 1980. Annual pulp capacity in 1981 was 6.76 million tons, produced by about 130 mills.

AFRICA

African paper and board production rose in 1981 by 5.6% to 1.81 million metric tons, largely due to increased South African production. Any major change in Africa's output is likely to be caused by South Africa, which produces more than twice as much paper and board as the rest of the continent combined.

In 1981, South Africa recorded an increase in production of just under 90,000 metric tons, with newsprint output rising 80,000 tons and printing/writing grades increasing by nearly 30,000 tons. There were small drops in some other grades.

One important addition was the startup of Zambia's first paper mill in mid-1981, which produced 16,000 metric tons. The country's first pulp mill was due to start in 1982, producing 14,000 tpy.

Based on available figures, total paper and board imports to Africa fell by about 2% to just under 900,000 metric tons in 1981, while exports rose by 22.1% to 200,000 tons. The continent's paper and board capacity was estimated to be nearly 2 million tons, produced by some 69 mills.

Africa's total pulp output in 1981 was 1.65 million metric tons, up 6.7% from 1980. South Africa was again the main producer with 1.12 million tons, an increase of over 100,000 tons.

In Cameroon, Cellulose du Cameroun's new Edea pulp mill produced its full 120,000 metric tpy of bleached kraft pulp for export in 1981. But in March 1982 an explosion destroyed the ClO_2 line. After a four-week closure, the mill restarted producing unbleached pulp. Full repair was expected to take several months.

Africa's pulp capacity is just under 2 million metric tons, produced by 29 mills. Pulp imports in 1981 were 270,000 tons, down 10.6%; and exports increased by 3.4% to 730,000 tons.

Throughout 1981, there were announcements of new small mills producing wastepaper-based paper or board. This development is reflected in a 31% increase in wastepaper consumption in 1981, reaching a total of 560,000 metric tons.

REVIEW OF TOP 20 PRODUCING NATIONS

Abridged data on production and export/import trade are given for those countries included in the tables of the Top 20 nations for paper/board production and pulp production

Australia

Population: 14,900,000. Per capita consumption of paper and board; 137 kg/308 lb. Paper and board mills: 17. Pulp mills: 16 (woodpulp, sulfate: 1; sulfite: 1; soda: 1; semichemical: 7; mechanical: 5; nonwood: 1)

Paper/board capacity: 1,730,000 e tons **Pulp capacity:** 875,000 e tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	1471	1394	747	741	119	90
Board		—	—	—	—	—
Total	**1471**	**1394**	**747**	**747**	**119**	**90**
Chemical woodpulp	490	442	271	252	na	na
Other pulps	223	219	5	2	na	na
Total	**713**	**661**	**276**	**254**	**na**	**na**

Austria

Population: 7,507,666. Per capita consumption of paper and board; 108 kg/238 lb. Paper and board mills: 36. Pulp mills: 22 (woodpulp, sulfate: 2; sulfite: 9; semichemical: 2; mechanical: 11)

Paper/board capacity: 1,911,000 tons **Pulp capacity:** 1,356,000 tons
Operating rate 1981: 87% **Operating rate 1981:** 89%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	903	935	96	111	551	610
Board	713	736	89	95	412	440
Total	**1616**	**1671**	**185**	**206**	**963**	**1050**
Chemical woodpulp	887	861	157	186	245	250
Other pulps	342	349	23	15	9	12
Total	**1229**	**1210**	**180**	**201**	**254**	**262**

Brazil

Population: 122,000,000. Per capita consumption of paper and board; 29 kg/64 lb. Paper and board mills: 160. Pulp mills: 48.

Paper/board capacity: 4,000,000 tons **Pulp capacity:** 3,900,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	2253	2062	202	234	151	219
Board	1214	1228	0	0	23	78
Total	**3467**	**3290**	**202**	**234**	**174**	**297**
Chemical woodpulp	3082	2910	58	15	772	769
Other pulps	425	na	8	6	3	0
Total	**3507**	**3500e**	**66**	**21**	**775**	**763**

Canada

Population: 24,200,000. Per capita consumption of paper and board; 197 kg/443 lb. Paper and board mills: 112. Pulp mills: 36.

Paper/board capacity: 15,600,000 tons **Pulpcapacity:** 23,100,000tons
Operating rate 1981: 87% **Operating rate 1981:** 86%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	11,045	11,255	194	274	8,625	8,753
Board	2344	2275	87	112	496	400
Total	**13,389**	**13,530**	**281**	**386**	**9121**	**9153**
Chemical woodpulp	12,125	11,370	87	77	6604	6076
Other pulps	7819	7905	53	60	585	515
Total	**19,944**	**19,275**	**140**	**137**	**7189**	**6591**

Chile

Population: 11,390,000. Per capita consumption of paper and board: 25 kg/56 lb. Paper and board mills: 18. Pulp mills: 7 (woodpulp, sulfate: 3; sulfite: 1; mechanical: 3)

Paper/board capacity: 379,100 tons **Pulp capacity:** 813,000 tons

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	303	300	48	52	79	55
Board	24	19	7	7	5	na
Total	**327**	**319**	**55**	**59**	**84**	**55**
Chemical woodpulp	633	618	—	—	436	384
Other pulps	131	125	—	—	—	—
Total	**764**	**743**	**—**	**—**	**436**	**384**

China, People's Rep. of

Population: 988,000,000. Per capita consumption of paper and board: 5.5 kg/12 lb. Paper and board mills: 1,600e

Paper/board capacity: 6,300,000 tons **Pulp capacity:** 5,600,000 tons

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	3410	3260	135	na	na	na
Board	1940	2140	575	na	na	na
Total	**5350**	**5400**	**710**	**na**	**178**	**192**
Chemical woodpulp	3380	3250	na	na	—	—
Other pulps	1110	1060	na	na	—	—
Total	**4490**	**4310**	**416**	**na**	**—**	**—**

Czechoslovakia

Population: 15,450,000. Per capita consumption of paper and board; 75 kg/165 lb. Paper and board mills: 49. Pulp mills: 24 (woodpulp, sulfate: 5; sulfite: 7; semichemical: 1; mechanical: 10; nonwood: 1)

Paper/board capacity: 1,282,000 tons **Pulp capacity:** 1,031,000 tons
Operating rate 1981: 96% **Operating rate 1981:** [illegible]

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	689	686	49	48	98	111
Board	335	539	82	78	66	80
Total	**1024**	**1225**	**131**	**126**	**164**	**191**
Chemical woodpulp	625	645	87	84	9	9
Other pulps	228	235	27	26	4	4
Total	**853**	**880**	**114**	**110**	**13**	**13**

Finland

Population: 4,800,000. Per capita consumption of paper and board; 198 kg/437 lb. Paper and board mills: 46. Pulp mills: 52 (woodpulp, sulfate: 18; sulfite: 9; semichemical: 3; mechanical: 22)

Paper/board capacity: 7,025,000 tons **Pulp capacity:** 8,510,000 tons

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	4493	4618	11	13	3688	3694
Board	1425	1517	29	29	1104	1141
Total	**5919**	**6135**	**40**	**42**	**4792**	**4835**
Chemical woodpulp	4590	4545	5	8	1732	1494
Other pulps	2644	2786	31	28	207	191
Total	**7234**	**7331**	**36**	**36**	**1939**	**1685**

France

Population: 54,000,000. Per capita consumption of paper and board; 115 kg/259 lb. Paper and board mills: 172. Pulp mills: 28 (woodpulp, sulfate: 8; sulfite: 4; semichemical and mechanical: 16)

Paper/board capacity: 5,500,000 tons **Pulp capacity:** 2,000,000 tons

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	3199	3170	1342	1425	811	844
Board	1954	1978	788	749	249	245
Total	**5153**	**5148**	**2130**	**2174**	**1060**	**1089**
Chemical woodpulp	1396	1301	1591	1585	169	149
Other pulps	433	415	61	66	3	4
Total	**1829**	**1716**	**1652**	**1651**	**172**	**153**

Fed. Rep. of Germany

Population: 61,666,000. Per capita consumption of paper and board: 157 kg/353 lb. Paper and board mills: 200. Pulp mills: 37 (woodpulp, sulfite: 11; semichemical: 1; mechanical: 25)

Paper/board capacity: 10,028,000 tons **Pulp capacity:** 2,322,000 tons

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	4758	4938	2592	2608	1117	1296
Board	2822	2857	1179	1124	592	646
Total	**7580**	**7795**	**3771**	**3732**	**1709**	**1942**
Chemical woodpulp	691	642	2237	2238	77	74
Other pulps	1304	1379	209	186	33	37
Total	**1995**	**2021**	**2446**	**2424**	**110**	**111**

Italy

Population: 57,180,422. Per capita consumption of paper and board; 87 kg/192 lb. Paper and board mills: 480. Pulp mills: 55 (sulfite: 2; semichemical: 5; mechanical: 28; nonwood: 20)

Paper/board capacity: 5,850,000 tons **Pulp capacity:** 1,350,000 tons
Operating rate 1981: 83% **Operating rate 1981:** 71%

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	2971	2933	782	792	533	654
Board	1964	1911	211	175	151	167
Total	**4935**	**4844**	**993**	**967**	**684**	**821**
Chemical woodpulp	167	189	1518	1397	8	12
Other pulps	908	773	107	72	1	—
Total	**1075e**	**962**	**1625**	**1469**	**9**	**12**

Japan

Population: 117,890,000. Per capita consumption of paper and board: 143 kg/321 lb. Paper and board mills: 593. Pulp mills: 68 (woodpulp, sulfate: 38; sulfite: 7; soda: 0; semichemical: 13; mechanical: 20; nonwood: 1)

Paper/board capacity: 22,473,000 tons **Pulp capacity:** 12,788,000 tons

	(000 metric tons)					
	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	10,536	9,944	245	250	307	360
Board	7552	7037	248	239	348	314
Total	**18,088**	**16,981**	**493**	**489**	**655**	**674**
Chemical woodpulp	7157	6272	1550	1176	99	103
Other pulps	2631	2,338	667	522	1	1
Total	**9788**	**8610**	**2,217**	**1,698**	**100**	**104**

Korea, Rep. of

Population: 38,723,000. Per capita consumption of paper and board; 42 kg/93 lb. Paper and board mills: 170e. Pulp mills: 5 (sulfate: 1; mechanical: 4)

Paper/board capacity: 2,180,000e tons
Operating rate 1981: 82e%

Pulp capacity: 314,000 tons
Operating rate 1981: 71%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	894	899	10	23	80	105
Board	799	885	13	13	74	76
Total	**1693**	**1784**	**23**	**36**	**154**	**181**
Chemical woodpulp	48	85	404	447	—	—
Other pulps	137	137	64	74	—	—
Total	**185**	**222**	**468**	**521**	—	—

Mexico

Population: 70,000,000. Per capita consumption of paper and board: 36 kg/79 lb. Paper and board mills: 60. Pulp mills: 27 (woodpulp, sulfate: 11; sulfite: 1; mechanical: 1, nonwood: 14)

Paper/board capacity: 2,556,000 tons
Operating rate 1981: 76%

Pulp capacity: 992,500 tons
Operating rate 1981: 75%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	1011	1075	312	461	—	—
Board	884	875	284	150	—	—
Total	**1895**	**1950**	**596**	**611**	—	—
Chemical woodpulp	396	408	164	76	—	—
Other pulps	335	335	44	46	—	—
Total	**731**	**743**	**208**	**122**	—	—

Netherlands

Population: 14,246,000. Per capita consumption of paper and board; 154 kg/340 lb. Paper and board mills: 35. Pulp mills: 5 (mechanical: 4; nonwood: 1)

Paper/board capacity: 1,880,000 tons
Operating rate 1981: 91%

Pulp capacity: 212,000 tons
Operating rate 1981: 77%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	868	820	846	830	473	466
Board	846	863	538	553	424	407
Total	**1714**	**1683**	**1384**	**1383**	**897**	**873**
Chemical woodpulp	—	—	564	515	9	3
Other pulps	206	162	60	45	7	1
Total	**206**	**162**	**624**	**560**	**16**	**14**

New Zealand

Population: 3,195,800. Per capita consumption of paper and board: 135 kg/304 lb. Paper and board mills: 5. Pulp mills: 6 (woodpulp, sulfate: 2; semichemical: 2; mechanical: 5)

Paper/board capacity: 797,632 tons
Operating rate 1981: 89%

Pulp capacity: 1,384,861 tons
Operating rate 1981: 84%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	491	510	39	41	323	315
Board	192	201	—	—	—	—
Total	**683**	**711**	**39**	**41**	**323**	**315**
Chemical woodpulp	569	619	11	6	217	245
Other pulps	578	541	—	—	258	269
Total	**1147**	**1160**	**11**	**6**	**475**	**514**

Norway

Population: 4,093,000. Per capita consumption of paper and board; 141 kg/311 lb. Paper and board mills: 23. Pulp mills: 27 (sulfate: 2; sulfite: 4; semichemical: 2; mechanical: 19)

Paper/board capacity: 1,650,000 tons
Operating rate 1981: 83%

Pulp capacity: 1,945,000 tons
Operating rate 1981: 83%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	1205	1233	98	74	938	924
Board	170	140	69	80	105	91
Total	**1375**	**1373**	**167**	**154**	**1043**	**1015**
Chemical woodpulp	455	563	202	278	63	141
Other pulps	1039	1045	4	5	308	297
Total	**1494**	**1608**	**206**	**283**	**371**	**438**

Portugal

Population: 9,905,000. Per capita consumption of paper and board: 51 kg/112 lb. Paper and board mills: 108. Pulp mills: 8 (sulfate, 5; sulfite, 2; soda, 1)

Paper/board capacity: 650,000 tons

Pulp capacity: 1,000,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	360	388	40	46	16	22
Board	175	181	24	30	131	122
Total	**535**	**569**	**64**	**76**	**147**	**144**
Chemical woodpulp	832	853	24	23	434	455
Other pulps	33	42	6	1	—	—
Total	**865**	**895**	**30**	**24**	**434**	**455**

Romania

Population: 22,000,000. Per capita consumption of paper and board: 32 kg/72 lb. Paper and board mills: 20. Pulp mills: 11 (woodpulp, sulfate: 6; sulfite: 3; semichemical: 1; mechanical: 1; nonwood: 4)

Paper/board capacity: 870,000 tons

Pulp capacity: 850,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	305	305e	na	na	na	na
Board	500*	500e*	na	na	na	na
Total	**805**	**805e**	**46**	**46e**	**167**	**167e**
Chemical woodpulp	645	645e	na	na	na	na
Other pulps	170	170e	na	na	na	na
Total	**815**	**815e**	**60**	**60e**	**26**	**26e**

*Board figures include packaging paper

South Africa

Population: 29,360,000. Per capita consumption of paper and board: 45 kg/101 lb. Paper and board mills: 16. Pulp mills: 10 (woodpulp, sulfate: 2; sulfite: 1; soda: 1; semichemical: 2; mechanical: 2; nonwood: 2)

Paper/board capacity: 1,321,000 tons

Pulp capacity: 1,193,000 tons

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	634	723	164	174	101	135
Board	566	565	89	80	38	39
Total	**1200**	**1288**	**253**	**254**	**139**	**174**
Chemical woodpulp	432	433	180	207	25	23
Other pulps	580	689	—	1	327	363
Total	**1012**	**1122**	**180**	**208**	**352**	**386**

Spain

Population: 37,500,000. Per capita consumption of paper and board: 70 kg/154 lb. Paper and board mills: 212. Pulp mills: 35 (sulfate, 14; sulfite, 1; semichemical, 1; mechanical, 10; nonwood, 10)

Paper/board capacity: 3,108,000 tons
Operating rate 1981: 83%

Pulp capacity: 1,652,000 tons
Operating rate 1981: 84%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	1415	1422	248	261	147	195
Board	1151	1166	119	90	117	115
Total	**2566**	**2588**	**367**	**351**	**264**	**310**
Chemical woodpulp	1113	1142	262	238	175	175
Other pulps	216	222	10	3	10	8
Total	**1329**	**1364**	**272**	**241**	**185**	**183**

Sweden

Population: 8,330,000. Per capita consumption of paper and board: 200 kg/441 lb. Paper and board mills: 58. Pulp mills: 64 (sulfate, 28, sulfite, 13; semichemical, 2; mechanical, 21)

Paper/board capacity: 6,860,000 tons
Operating rate 1981: 85.2%

Pulp capacity: 9,625,000 tons
Operating rate 1981: 80.7%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	3931	3931	123	124	2849	2918
Board	2258	2220	54	55	1675	1704
Total	**6189**	**6131**	**177**	**179**	**4524**	**4622**
Chemical woodpulp	6617	6531	44	68	2532	2442
Other pulps	2082	1998	1	10	449	380
Total	**8699**	**8529**	**45**	**78**	**2981**	**2822**

Taiwan

Population: 18,100,000. Per capita consumption of paper and board: 78 kg/176 lb. Paper and board mills: 160. Market pulp mills: 3 (sulfate, 1; nonwood, 2)

Paper/board capacity: 1,900,000 tons
Operating rate 1981: 79%

Pulp capacity: 450,000 tons
Operating rate 1981: 84%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	522	532	54	55	36	42
Board	927	966	26	21	111	129
Total	**1449**	**1498**	**80**	**76**	**147**	**171**
Chemical woodpulp	190	257	72	79	39	87
Other pulps	86	93	10	5	15	12
Total	**276**	**350**	**82**	**84**	**54**	**99**

U.S.S.R.

Population: 268,800,000. Per capita consumption of paper and board: 33 kg/73 lb. Paper and board mills: 84. Pulp mills: 56)

Paper/board capacity: 10,000,000 tons
Operating rate 1981: 90%

Pulp capacity: 8,450,000 tons
Operating rate 1981: 85%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	5294	5401	679	730	646	670
Board	3446	3555	214	270	372	380
Total	**8740**	**8956**	**893**	**1000**	**1018**	**1050**
Chemical woodpulp	7100	7160	—	—	823	945
Other pulps	1850	1900	—	—	—	—
Total	**8950**	**9060**	**—**	**—**	**823**	**945**

United Kingdom

Population: 55,950,000. Per capita consumption of paper and board: 124 kg/273 lb. Paper and board mills: 117. Pulp mills: 3 (semichemical, 2; mechanical, 1)

Paper/board capacity: 3,900,000 tons
Operating rate 1981: 87%

Pulp capacity: 180,000 tons
Operating rate 1981: 81%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	2177	1847	2647	—	402	—
Board	1616	1534	863	—	64	—
Total	**3793**	**3381**	**3510**	**—**	**486**	**—**
Chemical woodpulp	122	50	1393	1351	4	—
Other pulps	164	90	195	205	1	—
Total	**286**	**140**	**1588**	**1556**	**5**	**—**

United States

Population: 229,700,000. Per capita consumption of paper and board: 268 kg/591 lb. Paper and board mills: 612. Pulp mills: 248 (woodpulp, sulfate: 126; sulfite: 22; semichemical: 43; mechanical: 96)

Paper/board capacity: 66,007,000 tons
Operating rate 1981: 91%

Pulpcapacity: 52,980,000tons
Operating rate 1981: 94%

(000 metric tons)

	Production		**Imports**		**Exports**	
	1980	**1981**	**1980**	**1981**	**1980**	**1981**
Paper	28,631	29,198	7756	7322	852	936
Board	28,205	28,567	91	120	3281	2681
Total	**56,836**	**57,765**	**7847**	**7442**	**4133**	**3617**
Chemical woodpulp	40,333	41,094	3279	3316	2681	2619
Other pulps	5,692	6,065	396	391	771	718
Total	**46,025**	**47,195**	**3675**	**3707**	**3452**	**3337**

GLOSSARY OF INDUSTRY TERMS

A

ABRASION RESISTANCE. Resistance to the rubbing or wearing away by friction of a paper surface—including the paper itself as well as any printing or coatings on it.

ABSORBENCY. The property of paper that causes it to take up liquid or vapors it contacts.

AIR DRIED. Artificial drying of paper by contact with air over skeleton dryers after paper has been surface-sized.

ALUM. Aluminum sulfate, used to hard-size paper for improved water resistance.

APPARENT DENSITY. The weight per unit volume of a sheet, usually obtained by dividing the paper's basis weight by its caliper (thickness).

B

BOD (Biological Oxygen Demand). The amount of oxygen required for biological decomposition of waste in effluent (waste waters from the mill); an indirect measure of organic concentration in the effluent.

BASIS WEIGHT. The weight of a ream or other standardized measure of paper, expressed in pounds or in grams per square meter. By extension, the basis weight of one sheet of paper is the same as that of the standardized unit to which it belongs.

BASESTOCK. Paper that will be further processed, as in coating or laminating

BEATER. A large mixing tub where pulp or wastepaper is mixed with various additives, such as fillers, dyes and sizes. The action of the beater also serves to separate the pulp fibers.

BEATING. *See* Refining.

BINDERS BOARD. A paperboard grade, used in construction of hard-back book covers.

BISULFITE PULP. Sulfite pulp.

BOGUS. (Noun) Containerboard made from recycled waste materials. (Adjective) Used to describe any paper or board made from inferior materials.

BOND PAPER. A type of uncoated free-sheet paper used for stationery and printing.

BONDING STRENGTH. Also called "internal bonding strength." (1) The degree to which the fibers within a sheet of paper adhere to each other. (2) The strength of the bond between the paper or board stock and its coating or other surface application. (3) The extent to which the plies of a board or laminated sheet are bonded together.

BOOK PAPER. Uncoated free-sheet paper used in books and commercial printing.

BRIGHTNESS. The light-reflecting property of paper, measured against a reference standard.

BRISTOL. A heavyweight paper grade, solid or laminated, with caliper thickness of 0.006 in. and up, characterized by extreme hardness, foldability, and strength.

BROKE. Trimmings, manufacturing waste or damaged paper generated in a paper mill.

BULK. Term used to designate the thickness of a sheet of paper. A sheet with high bulk lacks compactness.

BURSTING STRENGTH (Mullen). The tensile strength and extensibility of paper or paperboard, measured as the pressure required to rupture a specimen in a specified instrument (Mullen) under specified conditions.

BUSINESS COMMUNICATION PAPERS. Papers for uses such as stationery, business forms, copier paper, checks and commercial printing.

C

CALENDER. An assembly of rolls at the end of the paper machine imparting a final finish to the paper, increasing gloss and smoothness.

CALENDER-FINISHED. Any paper with a surface glazed by calenders, such as machine finish, English finish, supercalendered and calender-friction glazed.

CALIPER. The thickness of a sheet measured under specified conditions. Caliper is usually expressed in thousandths of an inch (mils or points).

CARBONLESS COPY PAPER. A sheet capable of generating its own internal image, produced by pressure on its coated surface.

CARBONIZING PAPER. Lightweight basestock with proper finish on one or both sides, for later conversion into carbon paper.

CARLOAD. The minimum amount of paper required per freight car to qualify for shipment at the carload freight rate. This can be anywhere from 36,000 to 100,000 lb. Also refers to the amount of paper normally shipped in one freight car, since most shipments exceed the minimum carload requirement.

CASEMAKING MATERIALS. *See* Containerboard.

CAST-COATED PAPER. Gloss paper. A paper or board whose coating is allowed to harden or set while in contact with a finished casting surface. Cast-coated papers generally have a high gloss.

CELLULOSE. The chief structural element and main chemical constituent of the cell walls of trees and other plants; it comprises from 40% to 50% of wood and more than 98% of cotton fiber. Chemically, cellulose is a polymer composed of glucose monomers.

CELLULOSE WADDING. One or several layers of lightweight creped tissue, loose or bonded together, used for cushioning in packaging.

CHEMICAL PULP. Pulp obtained by the cooking of wood in an aqueous solution of various chemicals. The principal chemical pulp processes are the sulfite, sulfate (kraft) and soda.

CHEMITHERMOMECHANICAL PULP (CTMP). Pulpmaking process in which woodchips are treated with chemicals prior to or during presteaming, followed by atmospheric refining.

CHIPBOARD. Paperboard made from wastepapers, of relatively low density, used where strength and quality are not required.

CLARIFIER. Large settling basin used to remove solid waste material from mill effluent (waste waters).

COATED PAPER. Paper with surface coating that produces smooth finish, on one or both sides.

COATING. The layer of mixed clays and adhesives, etc. (or a plastic solution without pigment or binder) that is applied to the surface of paper or paperboard to create a new surface.

COMBINATION BOARD. Any paperboard made on a cylinder machine in which the outer plies (either one or both) are made from a different stock or are a different color than the middle layer.

COMBINED BOARD. A paperboard made by joining two or more boards together with an adhesive.

CONSTRUCTION PAPER. Heavy groundwood paper grade, in various colors, used for elementary school artwork.

CONSTRUCTION PAPER/BOARD. Construction papers (principally roofing felts) and building boards (insulation board and hard-pressed board), later converted into building products; usually not included in "paperboard" data.

CONTAINERBOARD. Linerboard and corrugating medium used in manufacturing corrugated shipping containers.

COOKING. Treating raw materials with chemicals under pressure and extreme heat to produce pulp for papermaking. Also referred to as "pulping."

CORD. The amount of wood contained in a pile of logs measuring 4 ft x 4 ft x 8 ft (128 ft^3). Approximately 85 ft^3 of solid wood.

CORRUGATED BOARD. Corrugating medium which has been passed through a corrugator and is pasted to a flat sheet of linerboard (single-faced corrugated board) or is pasted between two sheets of linerboard (double-faced corrugated board). The pasted sheets are designated as "containerboard."

CORRUGATING MEDIUM. Paperboard used as the fluted (corrugated) material in corrugated shipping containers. Also termed "ninepoint," which is the caliper of the board (0.009 in.).

COVER PAPER. Range of paper grades used for covers of catalogs, brochures and similar printed pieces.

CREPE PAPER. Paper given a crimped surface (by crowding it against a doctor blade during papermaking process), resulting in pliable, stretchable sheet.

CROSS DIRECTION. The direction at right angles to the machine direction in the plane of a sheet of paper.

CUNIT. 100 cubic feet of solid wood.

CURL. The tendency of paper by itself or in a laminate to bend or partly wrap around the axis of one of its directions.

CUT SIZE. Refers to business and writing papers that have been guillotined or rotary trimmed to dimensions of 8½x11 and 8½x14 in.; or any trimmed paper having dimensions of 16x21 in. or less.

CYLINDER MACHINE. A paper machine utilizing wire-covered cylinders or molds in which a web is formed from a dilute stock suspension.

D

DEINKING. The removal of ink, filler and other extraneous materials from printed or unprinted reclaimed papers through a combination of mechanical disintegration and chemical treatment, followed by washing, and, usually, bleaching. Flotation methods are also used to remove inks.

DIE CUT. The process by which paper or board is cut or stamped out to a specified shape or size with a steel die.

DIGESTER. Large reactor vessel in which wood is cooked in an aqueous solution to form chemical pulp.

DIMENSIONAL STABILITY. The property of a sheet of paper that relates to the constancy of its dimensions.

DUPLEX. Any paper or paperboard that has a different color, texture or finish on either side. Also, a general term applied to any multi-ply paper or board.

DRY END. The drying section of the paper machine in which the paper is dried and from which finished paper is wound onto a reel.

DRYERS. Steam-heated, hollow metal cylinders that dry the wet paper web as it passes around them in the paper machine.

E

ELECTROSTATIC PRINTING. A method of printing in which the ink is affixed to the web by electrostatic methods.

ELMENDORF TEST (Tear). A standard test for determining the tearing strength of paper. *See also* Tear.

ELONGATION (Stretch). Describes the "give" of a sheet of paper under tension, usually determined by means of a tensile tester.

EMBOSSED. A term applied to paper on which a raised or depressed design is pressed, die-stamped, or printed.

ENAMEL. Any glossy, shiny-surfaced, coated paper; also refers to a coating material on a paper.

ENCAPSULATED INK. Ink encapsulated with a coating giving a free-flowing dry system that can be activated by heat or pressure. Used for carbonless paper.

ENGLISH FINISH. Book paper with a finish more smooth than machine-finish and less smooth than supercalendered.

F

FABRIC. A fine-mesh woven screen on a paper machine on which paper is formed from a pulp slurry as water drains away.

FANFOLD. Continuous multiple-ply form manufactured from a single wide web that is folded longitudinally so as to form a flat pack, as differentiated from roll form. Also called zig-zag fold or flat pack.

FELT. A continuous belt made of wool or various combinations of wool, cotton, asbestos and/or synthetic fibers. Felts move the sheet through the paper machine, serving as a cushion and a medium for water removal.

FELT SIDE. The side of the paper web that has not been in contact with the wire during manufacture; the top side of the sheet.

FIBER. The threadlike units of vegetable growth that supply the structural basis of paper; also, synthetic filaments used in paper or other sheet materials ("synthetic fiber"). *See also* Secondary fiber.

FILLER. (1) A mineral pigment added to the fiber furnish to improve the opacity, color or printing qualities of paper. (2) In paperboard, the inner ply or plies as distinguished from the liners (outside plies).

FINE PAPER. A broad term for paper grades generally used for writing and printing, including bond, ledger, cover and book papers; as distinguished from wrapping and other coarse papers.

FINISH. (Noun) The surface property of a paper sheet determined by its surface contour and gloss (antique, eggshell, vellum, machine, English, supercalendered, plate, etc.). (Verb) To "finish" paper or paperboard is to cut, trim, sort and/or pack the paper, in finishing department of paper mill.

FLEXOGRAPHIC PRINTING. Formerly called aniline printing. A method of rotary letterpress printing that employs flexible plates and rapid-drying inks.

FLUFF PULP. Pulp, normally paper-grade kraft pulp, sold in rolls for fluffing. Fluff pulp is used as absorbent material in sanitary and health products.

FLUORESCENT PAPER. A paper that is coated with a fluorescent pigment that not only reflects a visible wavelength, but is activated by most of the remaining absorbed light to re-emit it as color of a longer wavelength, which results in reinforcement of the reflected color.

FORMATION. A property of paper that is determined by the degree of uniformity of distribution of the solid components of the sheet with special reference to the fibers.

FORMS BOND. *See* Register bond.

FOURDRINIER. A paper machine utilizing a horizontal, moving, fine-mesh screen on which paper is formed from a very dilute slurry of pulp and water.

FREE-SHEET. "Woodfree" paper containing 10% or less groundwood (mechanical) pulp.

FREENESS. The quality of pulp stock that determines the rate at which water drains from the stock suspension as it is being formed into a sheet on a wire mesh screen or perforated plate; usually measured on a Canadian Standard freeness tester, which has a perforated metal plate.

FURNISH. The mixture of various materials (pulp, sizes, wet-strength or other additives, fillers and/or dyes) that are blended in the stock suspension from which paper or paperboard is made.

G

GLASSINE PAPER. Translucent, smooth, grease-resistant paper made by extensive beating and subsequent supercalendering; made from primarily chemical pulps.

GLOSS. Light-reflective properties of a paper surface.

GRAIN. The direction in which the majority of fibers lie in the paper sheet, corresponding with the direction in which the paper is made on the machine ("machine direction").

GRAVURE PRINTING. An intaglio printing process employing minute engraved "wells." In general principle, deeply etched wells carry more ink than a raised surface, hence print darker values. Shallow wells are used to print light values. A doctor blade wipes the excess ink from the cylindrical printing surface. Rotogravure employs etched cylinders and web-fed stock. Sheet-fed gravure, as its name implies, involves individual sheet feeding.

GROUNDWOOD PULP. Pulp made by grinding wood with abrasive equipment (grinding stones) in the presence of water.

GROUNDWOOD PAPER. Paper containing a high percentage (over 10%) of groundwood pulp.

H

HAND. (Feel). A term used to express the impression obtained by handling paper to judge its finish, flexibility, and general quality.

HARD-SIZED. Any paper that has been treated with a large amount of size to make it highly water-resistant.

HARDWOOD. Wood from deciduous (broad-leaved) trees, having short fibers.

HEMICELLULOSE. A polysaccharide polymer associated with cellulose and also lignin in plant fibers; comprises between 20% and 30% of the chemical composition of wood.

HOLDOUT. The degree to which a sheet resists penetration by liquids, such as water or ink.

HOTMELTS. Molten plastics or waxes applied as a coating to paper or paperboard, forming an attractive, high-gloss surface with good flexible barrier properties (resistance to liquids and gases).

I

INDUSTRIAL PAPERS. Broad term covering papers manufactured for industrial uses, such as packaging, tissue and wrapping papers.

INTEGRATED MILL. A paper mill that produces all or almost all of the pulp it uses in papermaking.

INTERNAL BONDING STRENGTH. *See* Bonding strength.

J

JOB LOT. Out-of-specification paper that is sold at less than full price.

JUMBO ROLL. Industry term for large roll of paper.

K

KRAFT PAPER. Paper of high strength ("kraft"means strength in German), unbleached or bleached, produced from kraft (sulfate) pulp.

KRAFT PULP (Sulfate pulp). The strongest chemical pulp, made by the alkaline process of cooking wood in a solution of sodium hydroxide and sodium sulfide.

L

LACQUER. A solution or suspension of one or more materials in volatile solvents capable of forming a protective and/or decorative film, or a film with special surface properties, after the solvents have evaporated.

LAMINATED PAPER. Paper that is developed by fusing one or more layers of paper or paperboard together to the desired thickness and quality, or when other substances such as thin sheets of metal, plastic, cellophane, cloth, etc., are fused to paper.

LEDGER PAPER. A business paper grade, a strong sheet, used for accounting and records.

LETTERPRESS PRINTING. A printing process in which the ink is applied to paper, paperboard, or films from raised portions of printing plates or type.

LIGNIN. A complex, noncarbohydrate substance that, along with cellulose, forms and binds together the cell walls of plants; comprises between 20% and 40% of wood by weight.

LINERBOARD. Paperboard used as the outer, facing material in corrugated board used for shipping containers.

M

MICR (Magnetic Ink Character Recognition) PAPER. Writing papers that can be printed with magnetic ink, as used in data processing machines.

MACHINE-COATED. Paper that is coated, on one or both sides, on the paper machine.

MACHINE DIRECTION. Grain. The direction of the paper parallel to its forward movement on the paper machine.

MACHINE-FINISH (MF). (1) Any finish on a paper machine. It may be that of the sheet as it leaves the last dryer or as it leaves the calender stack, and either a dry or wet finish.
(2) When used with the name of a grade or type of paper, denotes a machine finish of less than the maximum range of smoothness.

MACHINE-GLAZED (MG) PAPER. Paper with a high, glossy finish on one side of the sheet only, made on a yankee machine and used for wrapping and poster work.

MANIFOLD. A lightweight, dense paper, usually in basis weight of 7 to 9 lb, with unglazed or machine-glazed finish, used primarily for carbon copies of typewritten material.

MATTE FINISH. A dull finish with little or no gloss.

MECHANICAL PULP. Pulp produced by mechanical rather than chemical processes; includes stone groundwood, refiner groundwood, thermomechanical, defibrated and exploded pulp. *See* chapter on Pulping Processes.

MEDIUM. *See* Corrugating medium.

MOISTURE CONTENT. Percent of moisture. The moisture present in a material, as determined by specified methods.

MOISTUREPROOF. The property of a material that makes it substantially impervious to water vapor.

MOISTURE VAPOR TRANSMISSION. The rate at which water vapor permeates a paper.

MOTTLE. Nonuniform coloring of a sheet of paper, whether intentional or accidental.

MULLEN. *See* Bursting strength.

MULTI-PLY. Consisting of two or more plies, or layers.

N

NEWSPRINT. A generic term used to describe paper of the type used for printing newspapers.

NINEPOINT. *See* Corrugating medium.

NONWOVEN FABRIC. A clothlike material made of fibers longer than those normally used in papermaking; instead of being woven on a loom, the fibers are matted together by means of several different processes, including formation on paper machines.

O

OCR (Optical Character Recognition). An information processing technology dealing with the conversion of imprinted or written data to another language and medium.

OFF-MACHINE COATED PAPER. Paper that is coated, on one or both sides, after it has been removed from the paper machine.

OFFSET PRINTING. A process of indirect printing in which an impression of type or a design on a flat plate is printed on a rubber-blanketed cylinder from which it is impressed ("off-set") upon the surface to be printed.

ONIONSKIN. Lightweight paper, basis weight 7 to 9 lb, often with cockle finish, used primarily for copies in office correspondence.

OPACITY. The property of a sheet of paper that obstructs the passage of light and prevents print or any object on or in contact with the other side from being seen through the sheet; the opposite of "showthrough."

P

PAPER. A web or sheet of fibers (primarily cellulose), formed on a fine wire or fabric from a water suspension.

PAPER STOCK. Wastepaper which is reused in manufacture of paper and paperboard, generally after it has been sorted into various recognized grades.

PAPETERIE. Woodfree paper used for stationery, greeting cards, etc.

PATENT COATED. Denotes a cylinder grade of boxboard that has been vat-lined on one or both sides with a white stock to improve the surface.

PICK. Refers to the tendency of fibers or particles of a sheet of paper to be pulled away from the sheet surface by tacky surfaces such as printing plates.

PIGMENT. A mineral or organic additive used to color paper or coating, or to develop opacity.

PLY. A web or layer of paper or paperboard.

POINT. Caliper measurement of a sheet of paper, in thousandths of an inch (0.001 in.).

POROSITY. The degree to which a paper contains connected air pockets. Porosity affects the absorbency of a paper, and is measured by determining the rate of air flow through a given sheet of paper in a densometer.

PRESSURE-SENSITIVE PAPER. Paper coated on one or both sides with adhesive, which is activated by pressure. Usually used in the manufacture of labels and tapes.

PRINTABILITY. Refers to paper properties that determine the quality of appearance of the sheet after printing, as judged by uniformity of color of the printed areas, uniformity of ink transfer, contrast, legibility, and so forth. Printability is determined by the paper's ink receptivity, uniformity, compressibility, smoothness, opacity, color and resistance to picking.

PULP. Primary raw material from which paper is made; a fibrous product produced by mechanical or chemical processes (or a combination). *See* chapter on Pulping Processes.

R

RAG CONTENT. Also called "cotton fiber content"; indicates that a percentage of a sheet of paper is made up of cotton fiber. For a paper to qualify as "rag-content paper," it must contain a minimum of 25% cotton fiber, and may be high as 100% cotton or "rag."

REAM. A quantity of sheets of paper, usually 500 sheets (in rare cases, 480 sheets).

REFINER MECHANICAL PULP (RMP). Pulpmaking process in which woodchips are refined under atmospheric conditions without pretreatment.

REFINING. The mechanical treatment of pulp in a water suspension to convert the fiber into a form suitable for papermaking.

REGISTER. The exact, corresponding placement of successively printed images.

REGISTER BOND. A lightweight bond paper used primarily for business forms and computer printouts.

RELATIVE HUMIDITY. The ratio of the amount of moisture in the air at any temperature to the amount required at that temperature to saturate the air.

RELEASE PAPER. A group of papers specifically designed for easy stripping from or nonadherence to tacky surfaces.

ROSIN. The residue obtained after distilling off the volatile matter (turpentine) from the gum of southern pine, commonly used for internal (beater) sizing.

ROTOGRAVURE PRINTING. *See* Gravure printing.

RUNABILITY. The efficiency with which a paper can be printed and handled in the press, and the paper's ability to withstand the stresses of the printing process unaltered.

S

SCREENINGS. Knots of pulp and other materials too coarse to pass through pulp or stock screens, separated or screened from the stock before it contacts the paper machine wire. Screenings are often used to make coarse papers or paperboards.

SECONDARY FIBER. Fiber that has been previously used for papermaking, including stock reclaimed from post-consumer wastepaper and converting plant waste as well as " broke" (*see* Broke).

SEMICHEMICAL. Pulp made by a combination of mechanical and chemical processes and usually used for corrugating medium.

SHEET. (1) A single leaf of paper as distinct from a roll. (2) Any paper not in roll form. (3) Paper, in general.

SILK SCREEN PRINTING. A method of printing in which the ink is forced through a design on a taut silk screen, made of bolting cloth, onto the object to be printed.

SILVICHEMICALS. Chemicals derived from wood, including byproduct chemicals from pulping processes.

SIZE. Any substance used in or on paper to make it water- or ink-resistant, such as rosin, glue, gelatin, starch, latex, synthetic resins.

SIZE PRESS. The section near the end of the paper machine where paper is surface-treated with starch or other sizing solutions.

SLURRY. A suspension in water or adhesive solution of pigments or other insoluble materials used in coating or papermaking.

SLUSH. A highly watery suspension of paper pulp that flows easily and can be pumped.

SODA PULP. Chemical pulp made principally from hardwoods by cooking the wood in a solution of caustic soda. Generally used in combination with bleached sulfite or kraft pulp for the manufacture of book and printing papers.

SOFTWOOD. Wood from coniferous (needled) trees, having long fibers.

SOLID BOARD. A general term indicating that the board is made of the same material throughout, as contrasted with a combination board in which two or more stocks are used.

SPENT LIQUOR. Cooking liquor that has been used in the manufacture of chemical pulp and that contains lignin, resins, and other substances extracted from wood.

SPLICE. The joining of the ends of two webs of paper to make a continuous roll.

STANDARD CONDITION. Standard conditions for paper testing, normally specified as 73°F ±2° and 50% ±3% relative humidity.

STARCH. The chief sizing agent used for paper.

STIFFNESS. The ability of paper or paperboard to resist deformation under stress.

STOCK. (1) Furnish. (2) Wet pulp of any type at any stage of the manufacturing process.

STRIKETHROUGH. Penetration of ink through a sheet of paper so that it shows through on the unprinted side.

SULFATE PULP. *See* Kraft pulp.

SULFITE PULP. Chemical pulp made by the acid process of cooking wood in a solution of sulfurous acid and a bisulfite salt. Bisulfite pulp.

SUPERCALENDER. Off-machine calender rolls that heat and iron paper to produce a high-gloss finish.

SURFACE-COATED. Term applied to paper or paperboard that has one or both sides coated with a pigment or other coating material.

SURFACE COLORING. The application of color to paper after the web has been formed on the paper machine; may be done on-machine at the calender rolls or off-machine as a separate operation.

SURFACE-SIZED. Any paper to which size has been applied when the sheet is dry or partially dry, at the size press or in a separate operation.

SYNTHETIC FIBER. Any manmade fiber, including those derived from cellulose, such as rayon and acetate, as well as the purely manmade, such as nylon and acrylic fiber.

T

TACK. The stickiness or pulling power of ink or adhesives.

TALL OIL. A byproduct of chemical pulping derived from spent liquors, containing principally rosin and fatty acids, with some sterols, alcohols, and other materials; used in soaps, lubricants, greases, rubber, paints, chemicals.

TARNISHPROOF PAPER. Refers to a paper being free of substances that will discolor or blemish copper or silver.

TEAR. The resistance of a sheet of paper to tearing; measured with an Elmendorf tear tester as the force in grams necessary to tear a strip of paper.

TENSILE STRENGTH. The force, parallel to the plane of the specimen, required to break a given width and length of paper under specified conditions.

TEST LINER. Bogus or recycled linerboard.

TEXT PAPER. High-quality printing papers.

THERMOMECHANICAL PULP (TMP). Pulpmaking process using presteaming and pressurized refining of untreated (no chemical treatment) woodchips.

TRANSPARENCY. That property of a material that transmits light rays so that objects can be distinctly seen through the specimen.

TRIM. The width of the sheet of paper at the dry end of a paper machine.

TWIN-WIRE MACHINE. A paper machine using two forming wires. Sections of the two wires are close to each other and parallel. A pulp slurry is injected between the two wires and water is removed from both sides of the sheet of paper as it is formed.

TWO-SIDEDNESS. Refers to the subtle yet definite difference in shade or texture between the felt and wire sides of a sheet of paper.

V

VEGETABLE PARCHMENT. A grease- and water-resistant paper resembling animal parchment made by passing unsized paper through sulfuric acid in order to gelatinize its surface, followed by washing and drying.

VELLUM FINISH. Toothy surface, relatively absorbent for fast ink penetration, usually applied to text papers.

W

WASTEPAPER. Pre-consumer waste (mostly trim and clippings from converting plants) and post-consumer waste (used newspapers, old corrugated containers, office waste, etc.) used in manufacture of paper and paperboard.

WEB. The continuous sheet of paper coming from the paper machine in its full width or from a roll of paper in any converting operation.

WET END. The front section of the paper machine where the pulp slurry is introduced for formation into paper.

WET MACHINE. A one-cylinder machine used to form pulp into thick, rough sheets sufficiently dry to permit folding into laps (bundles); also used to make certain types of heavy boards, the thick wet sheets being dried flat in specially constructed dryers.

WET STRENGTH. The tensile strength of a sheet of paper when completely wet; sometimes calculated as a percentage of its dry strength.

WET-STRENGTH PAPER. Paper with an extremely high resistance to tearing or disintegration when completely wet. To qualify as wet-strength paper, a sheet must retain over 15% of its dry tensile strength when saturated with water.

WHITE PAPERS. *See* Business communication papers.

WIRE. A fine-mesh metal wire or plastic screen on the paper machine on which paper is formed from a pulp slurry as water drains away.

WIRE MARK. The impression of the machine wire or dandy roll of the paper machine in the paper.

WIRE SIDE. The side of a sheet of paper that has had contact with the wire of the paper machine during manufacture. Paper from a twin-wire machine has two wire sides.

WOODFREE. Pulp: chemical pulp. Paper: Paper grades made from chemical pulp.

Y

YANKEE MACHINE. A type of fourdrinier or cylinder machine having a single drying cylinder with a highly polished surface, used for making machine-glazed paper or for drying tissue.

METRIC CONVERSION GUIDE

Pertinent conversion tables reproduced from 'Metrication for the Pulp and Paper Industry' by Kenneth E. Lowe (Miller Freeman Publications, 1975)

CONVERSION LIST FOR NORTH AMERICAN AND METRIC UNITS

To convert	Into	Multiply by
acre	hectare	0.4047
Btu (mean)	joule	1.05587×10^3
centimeter	foot	0.03281
	inch	0.3937
cord	(see Forestry Terms)	
foot	centimeter	30.48
	meter	0.3048
gallon (U.S. liquid)	gallon (U.K.)	0.8327
	liter	3.785
gallon (U.K.)	gallon (U.S. liquid)	1.20094
	liter	4.545
horsepower (electric)	kilowatt	0.746
horsepower-hour	kilowatt-hour	0.746

To convert	Into	Multiply by
inch	centimeter	2.54
	meter	0.0254
joule	Btu	9.4845×10^{-4}
	calorie (mean)	0.23866
kilogram-mass	pound (avdp)	2.2046
	ton (metric)	0.001
	ton (short)	1.102×10^{-3}
kilometer	foot	3281
	mile (statute)	0.6214
kilowatt	horsepower (electric)	1.34
kilowatt-hour	horsepower-hour	1.34
liter	gallon (U.K.)	0.21998
	gallon (U.S. liquid)	0.2642
meter	foot	3.281
ounce (avdp)	gram	28.3495
	pound (avdp)	0.0625
pound (avdp)	kilogram	0.4536
pound/inch^2 (psi)	kilogram-force/cm^2	0.07031
square foot	square centimeter (cm^2)	929.0
	square meter (m^2)	0.09290
square meter	square foot (ft^2)	10.76
	square inch (in.^{2})	1550
ton (long)	ton (metric)	1.016
	ton (short)	1.120
ton (metric)	ton (long)	0.9842
	ton (short)	1.1023
ton (short)	ton (long)	0.89286
	ton (metric)	0.90718
yard	centimeter	9.144
	meter	0.9144

FACTORS FOR CONVERTING REAM AND BASIS WEIGHTS TO GRAMMAGE

Paper grade	Trade size 500-sheet ream (in.)	Grammage (g/m^2) to ream or basis weight[1]	Ream weight[2] to grammage
Writing and printing	17 x 22	0.266	3.760
Demy size	17½ x 22½	0.280	3.571
Blotting	19 x 24	0.324	3.083
Cover	20 x 26	0.370	2.704
Tissue (double-crown size)	20 x 30	0.427	2.343
Cardboard	22 x 28	0.438	2.282
Bristol and tag	22½ x 28½	0.456	2.195
News and wrapping (3000 ft^2)	24 x 36	0.614	1.627
Book	25 x 38	0.675	1.480
Former standard size	25 x 40	0.711	1.406
Paperboard	1000 ft^2	0.205	4.881

Source: Based on TAPPI Standard T410.

Note: If the conversion factor for a sheet size is not listed, the ream weight or grammage can be calculated by the following formulas:

Converting ream weight (lb/500 sheets) to grammage:

$$\text{g/m}^2 = \frac{\text{ream weight x 1406}}{\text{sheet area in square inches}}$$

Converting grammage to ream weight in lb/500 sheets:

$$\text{lb/ream} = \text{g/m}^2 \text{ x sheet area in square inches x 0.000711}$$

1. If the given trade size is in 480 sheets, then factor should be multiplied by 48/50 (or 0.960).
2. If the given trade size is 480 sheets, then factor should be multiplied by 1.042.

COMPARISON OF ISO AND NORTH AMERICAN PAPER SIZES

ISO SIZES			NORTH AMERICAN SIZES		
	Millimeters	Inches		Millimeters	Inches
A0	841 x 1189	33⅛ x 46¾	NA0	889 x 1143	35 x 45
A1	594 x 841	23⅜ x 33⅛	NA1	559 x 864	22 x 34
A2	420 x 594	16½ x 23⅜	NA2	432 x 559	17 x 22
A3	297 x 420	11⅔ x 16½	NA3	279 x 432	11 x 17
A4	210 x 297	8¼ x 11¾	NA4	216 x 279	8½ x 11
A5	148 x 210	5⅞ x 8¼	NA5	139 x 216	5½ x 8½
A6	105 x 148	4⅛ x 5⅞	NA6	108 x 139	4¼ x 5½

METRIC UNITS FOR COMMONLY USED TERMS IN FORESTRY

Term	North American symbol or definition	Suggested metric unit	Equivalent
LAND AREA			
Acre		hectare (ha)	1 acre = 0.4047 ha
Square mile	640 acres	hectare (ha)	1 mi^2 = 259.0 ha
		square kilometer (km^2)	1 mi^2 = 2.59 km^2
Section	640 acres	hectare (ha)	1 section = 2.59 km
Township	36 square miles (mi^2)	hectare (ha)	1 township = 9324 ha
LUMBER AND BOARD MEASUREMENTS			
Board foot	bdf	cubic meter (m^3)	1 bdf = 0.002360 m^3
1000 board feet	1000 bdf	cubic meter (m^3)	1000 bdf = 2.360 m^3
Cubic foot	ft^3	cubic meter (m^3)	1 ft^3 = 0.02832 m^3
Square foot	ft^2	square meter (m^2)	1 ft^2 = 0.09290 m^2
Thickness	in.	millimeter (mm)	1 in. = 25.4 mm
WOOD AND PULPWOOD MEASUREMENTS			
Cord	128 ft^3	cubic meter (m^3)	1 cord = 3.624 m^3
Unit	160 ft^3 (wood)	cubic meter (m^3)	1 unit (160 ft^3) = 4.528 m^3
	200 ft^3 (chip)	cubic meter (m^3)	1 unit (200 ft^3) = 5.664 m^3
Cunit	100 ft^3 (solid)	cubic meter (m^3)	1 cunit = 2.832 m^3
Cubic foot	ft^3	cubic meter (m^3)	1 ft^3 = 0.02832 m^3
Yield/acre	ft^3/acre	cubic meter/hectare (m^3/ha)	1 ft^3/acre = 0.06998 m^3/ha

CONVERSIONS FOR ACCOUNTING

Unit cost	Multiply by	To obtain
AREA		
$/acre	2.47105	$/hectare
$/square foot	10.7639	$/square meter
$/1000 square feet	0.0107639	$/square meter
	10.7639	$/1000 square meters
$/3000 square feet	0.0035879	$/square meter
ELECTRICAL		
$/kilowatt-hour	1.0	$/kilowatt-hour
	0.277778	$/megajoule
ENERGY		
$/cubic foot (gas)	35.3147	$/cubic meter
$/1000 cubic foot (gas)	35.3147	$/1000 cubic meters
$/gallon (U.S.)	(see Volume)	
$/gallon (U.K. liquid)	(see Volume)	
FREIGHT		
$/ton (2000 lb)	(see Weight)	$/metric ton
$/ton-mile	0.6849	$/metric ton-kilometer
LABOR		
ton (2000 lb)/man-day	0.9072	metric ton/man-day
$/ton (2000 lb)	1.10231	$/metric ton
VOLUME		
$/gallon (U.S.)	0.264173	$/liter
	264.173	$/cubic meter
$/gallon (U.K.)	0.219969	$/liter
	219.969	$/cubic meter
$/1000 gallons (U.S.)	0.264173	$/1000 liters
	0.264173	$/cubic meter
$/million gallons (U.S.)	0.264173	$/1000 cubic meters
$/cubic foot	35.3147	$/cubic meter
$/cubic yard	1.30795	$/cubic meter

Unit cost	Multiply by	To obtain
WEIGHT (MASS)		
$/pound	2.20462	$/kilogram
$/100 pound (cwt)	0.0220462	$/kilogram
$/short ton (2000 lb)	1.10231 (0.9072)	$/metric ton
$/long ton (2240 lb)	0.984206	$/metric ton
WOOD VOLUME		
$/board foot	423.76	$/cubic meter
$/1000 board feet	0.42376	$/cubic meter
$/cubic foot	35.3147	$/cubic meter
$/cord (128 ft^3)	0.2759	$/cubic meter
$/unit (wood)	0.2208	$/cubic meter
$/unit (chip)	0.1766	$/cubic meter
$/cunit (100 ft^3)	0.3531	$/cubic meter

For example, assume the selling price for 42-lb linerboard is $300/ton. Calculate the price per 1000 m^2:

$$\frac{300 \times 42.0}{2000} = \$6.30/1000 \text{ ft}^2\text{; thus}$$

$$6.30 \times 10.764 = \$67.81/1000 \text{ m}^2$$

Another formula for calculating price on a 1000-m^2 basis is:

$$\$/1000 \text{ m}^2 = (\$/\text{metric ton})\ (\text{grammage})\ (0.001)$$

For example, assume that the selling price of linerboard with a grammage of 205 g/m^2 is $400/metric ton. Calculate the price per 1000 m^2:

$$400 \times 205 \times 0.001 = \$82.00/1000 \text{ m}^2$$

SOURCES OF INDUSTRY INFORMATION

This list comprises publications about the pulp and paper industry, with emphasis on economics and marketing aspects and excluding manufacturing technology. Periodicals, books and special studies are listed alphabetically by title, with frequency of publication (or date of issue), and name and address of publisher or distributor.

Special reports and surveys (generally priced at $1000 or higher) are listed in a second section.

Firms providing special market reports are listed in the final section.

Analysis of Demand and Supply for Secondary Fiber in U.S. Paper and Paperboard Industry
(3 volumes, 1975)
By Arthur D. Little Inc., for Resource Recovery Div.,
Office of Solid Waste Management Programs,
Environmental Protection Agency
Washington, D.C. 20460

Analysis of Paper Markets (semiannual)
International Resource Development Inc.
30 High St., Norwalk, Conn. 06851

Annual Review of Pulp and Paper Mill Projects Worldwide (annual)
Jaakko Poyry Consulting Oy
Box 16, SF-00401 Helsinki 40, Finland

Boxboard Containers (monthly)
Maclean-Hunter Publishing Corp.
300 W. Adams St., Chicago, Ill. 60606

Canada: Exports by Commodities and Countries
(Catalog 65-004; monthly)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

Canada: Imports by Commodities and Countries
(Catalog 65-007; monthly)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

Canadian Paper Analyst (monthly)
JDR Publications
P.O. Box 300, Victoria Station
Westmount, Que. H3Z 2V5, Canada

Canadian Pulp and Paper Capacity (annual)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9, Canada

Canadian Pulp & Paper Industry
(*see* Pulp and Paper Journal)

Capacity Survey (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Capital Spending
(*see* Mill-by-Mill Listings)

1977 Census of Manufactures
Pulp Mills (SIC 2611)
Paper Mills, except Building Paper (SIC 2621)
Paperboard Mills (SIC 2631)
Building Paper & Board Mills (SIC 2661)
other SIC 26 reports available
U.S. Dept. of Commerce, Bureau of Census
Subscriber Services (Publications)
Washington, D.C. 20233

1977 Census of Manufactures, Vol. 2, Industry Statistics, Part 1, SIC major groups 20-26
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Competitive Grade Finder for the Paper and Graphic Arts Industry (annual)
Grade Finders Inc.
P.O. Box 444, Bala-Cynwyd, Pa. 19004

Current Industrial Reports: Pulp, Paper & Board (M26A) (formerly monthly and annual; as of 1982, annual)
U.S. Dept of Commerce, Bureau of Census
Subscriber Services (Publications)
Washington, D.C. 20233

Dictionary of Paper (Fourth edition, 1980)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options: Vol. V, Pulp and Paper Industry Report (1976)
U.S. Environmental Protection Agency
Office of Research & Development
Industrial Environmental Research Laboratory
Cincinnati, Ohio 45628

available through National Technical Information
Service, Springfield, Va. 22161

Estimated Production of Pulp, Paper and Paperboard in Certain Countries (annual)
Food & Agriculture Organization, United Nations
Via della Terme di Caracalla, 00100 Rome, Italy

Exports of Linerboard and Corrugating Material (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Fibre Market News (3 times weekly)
Market News Publishing Corp.
156 Fifth Ave., New York, N.Y. 10010

Fiber Statistics Subscription Service
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Forest Products and Paper Industry (monthly)
Evadna S. Lynn and Richard S. Palm
Merrill Lynch, Pierce, Fenner & Smith Inc.
Securities Research Division
165 Broadway, New York, N.Y. 10080

Forest Products Review (quarterly)
Bureau of Industrial Economics, U.S.D.C.
Superintendent of Documents
Government Printing Office, Washington, D.C. 20402

Hay-Roe's PaperTree Letter (monthly)
PaperTree Economics Ltd.
105—900 W. Georgia St., Vancouver, B.C. V6C 1P9,
Canada

Impact of Communication Technology on Demand for Printing and Writing Papers (1980)
Compiled by Euro-Data Analysts, U.K.
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Industrial Paper and Board Products (biannual)
Data-Transcripts
90 High St., Wingham, Kent CT3 1DE, U.K.

International Competition in Pulp, Paper and Paperboard: the Future North American Position and its Implications (1982)
By Arthur D. Little Inc.
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

1981-82 International Directory of the Nonwoven Fabrics Industry (7th edition, 1981)
Assn. of Nonwoven Fabrics Industry
1700 Broadway, New York, N.Y. 10019

International Glossary of Technical Terms for the Pulp and Paper Industry (1976)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

International Report (intermittent)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Kline Guide to the Paper Industry (triennial)
Charles H. Kline & Co. Inc.
330 Passaic Ave., Fairfield, N.J. 07006

Lockwood's Directory of the Paper and Allied Trades (annual)
Vance Publishing Corp.
113 E. 58th St., New York, N.Y. 10022

Market Pulp—Worldwide Supply and Demand (1981)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Metrication for the Pulp and Paper Industry (1975)
By Kenneth E. Lowe
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Mill-by-Mill Listings (semiannual)
PULP & PAPER Project Report
500 Howard St., San Francisco, Calif. 94105

Monthly Newsprint Statistics (monthly)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9,
Canada

Monthly Paper Stock Statistics (monthly)
National Assn. of Recycling Industries Inc.
330 Madison Ave., New York, N.Y. 10017

Monthly Pulpwood Summary (monthly)
American Pulpwood Assn.
1619 Massachusetts Ave. N.W.
Washington, D.C. 20036

Monthly Statistical Summary (monthly)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

NCRR Bulletin (quarterly)
National Center for Resource Recovery Inc.
1211 Connecticut Ave. N.W.
Washington, D.C. 20036

New Pulps for the Paper Industry (1979)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Newsprint Data (annual)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9,
Canada

North America in the 80s: Pulp, Paper and Paperboard: the Competitive Position and its Implications (1980)
By A.D. Little Inc. and PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Official Board Markets (weekly)
Harcourt Brace Jovanovich Inc.
20 N. Wacker Dr., Chicago, Ill. 60606

PPI/PULP & PAPER INTERNATIONAL
(monthly except twice in July)
Miller Freeman Publications
Chaussée de Charleroi 123a, Bte 5
B-1060 Brussels, Belgium

also 500 Howard St., San Francisco, Calif. 94105

PPI/International Pulp & Paper Directory (biennial)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PPI Newswire Service (weekly)
PPI Newswire Service
Chaussée de Charleroi 123a, Bte 5
B-1060 Brussels, Belgium

PPI Projects Survey (annual)
PULP & PAPER INTERNATIONAL
Chaussée de Charleroi 123a, Bte 5
B-1060 Brussels, Belgium

PPI Top 100 Companies in World (annual)
PULP & PAPER INTERNATIONAL
500 Howard St., San Francisco, Calif. 94105

Paper (semi-monthly)
Benn Publications Ltd.
25 New Street Sq., London EC4 3JA, U.K.

Paper Age (monthly)
Business Press Inc.
101 West St., Hillsdale, N.J. 07642

Paper Bag Market (1979)
Morton Research Corp.
1745 Merrick Ave., Merrick, N.Y. 11566

Paper Basics (1978)
By David Saltman
Van Nostrand Reinhold Co.
130 W. 50th St., New York, N.Y. 10020

Paper Coated Products (1979)
Morton Research Corp.
1745 Merrick Ave., Merrick, N.Y. 11566

Paper, Film & Foil Converter (monthly)
Maclean-Hunter Publishing Corp.
300 W. Adams St., Chicago, Ill. 60606

Paper and Forest Products Monthly (monthly)
Ron Hartzog and Mary Fraser
Donaldson, Lufkin & Jenrette
140 Broadway, New York, New York 10005

Paper Industry Monthly (monthly)
Thomas P. Clephane and Jeanne Carroll
Morgan Stanley, Investment Research
1251 Ave. of the Americas, New York, N.Y. 10020

Paper Industry News Digest (biweekly)
Albany International Corp.
Paper Industry Div.
P.O. Box 1939, Appleton, Wis. 54913

Paper Industry: Outlook for Market Pulp (1981)
Kidder, Peabody & Co., Institutional Services Dept.
10 Hanover Square, New York, N.Y. 10005

Paper Merchant Sales Report (monthly)
National Paper Trade Assn.
111 Great Neck Rd., Great Neck, N.Y. 11021

Paper Production Report (weekly)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Paper Products Market (1979)
Morton Research Corp.
1745 Merrick Ave., Merrick, N.Y. 11566

Paper Sales (monthly)
Harcourt Brace Jovanovich Inc.
757 Third Ave., New York, N.Y. 10017

Paper Trade Journal (semi-monthly)
Vance Publishing Corp.
133 E. 58th St., New York, N.Y. 10022

Paper Year Book (annual)
Harcourt Brace Jovanovich Inc.
757 Third Ave., New York, N.Y. 10017

Paperboard Packaging (monthly)
Harcourt Brace Jovanovich Inc.
747 Third Ave., New York, N.Y. 10017

Paperboard Statistics News Release (weekly)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Pima (monthly)
Pima (Paper Industry Management Assn.)
2400 E. Oakton, Arlington Heights, Ill. 60005

Pima Directory (annual)
Pima (Paper Industry Management Assn.)
2400 E. Oakton, Arlington Heights, Ill. 60005

Pima Pulp & Paper Mill Catalog (annual)
Pima (Paper Industry Management Assn.)
2400 E. Oakton, Arlington Heights, Ill. 60005

Plastics and the Paper Industry (1975-78)
Wolpert & Jones (Studies) Ltd.
24 St. John's Rd., London NW11 0PG, U.K.

Pocket Pal/Graphic Arts Production Handbook
International Paper Co.
77 W. 45th St., New York, N.Y. 10036

Post's Pulp & Paper Directory (annual)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Presstime (monthly)
American Newspaper Publishers Assn.
Box 17407, Dulles International Airport
Washington, D.C. 20041

Price/Export-Import Databook 1980 (1980)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Production, Prices, Employment & Trade in Northwest Forest Industries (quarterly)
Pacific Northwest Forest & Range Experiment
Station, Forest Service, U.S. Dept. of Agriculture
809 N.E. 6th Ave., Portland, Ore. 97232

Projected Pulp and Paper Mills in the World (annual)
Food & Agriculture Organization, United Nations
Via delle Terme di Caracalla, 00100 Rome, Italy

PULP & PAPER (monthly except twice in November)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

PULP & PAPER Buyers Guide (annual)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulp & Paper Canada (monthly)
Southam Business Publications
310 Victoria Ave., Westmount, Que. H3Z 2M9, Canada

Pulp & Paper Canada Annual and Directory (annual)
Southam Business Publications
310 Victoria Ave., Westmount, Que. H3Z 2M9, Canada

Pulp and Paper Capacities (annual)
Food & Agriculture Organization, United Nations
Via delle Terme di Caracalla, 00100 Rome, Italy

Pulp and Paper Industry (annual)
OECD/Organization for Economic Cooperation
and Development, Paris, France
OECD Publications Center
1750 Pennsylvania Ave. N.W.
Washington, D.C. 10006

Pulp and Paper Journal (8 times a year)
Maclean-Hunter Ltd.
481 University Ave., Toronto, Ont. M5W 1A7, Canada

Pulp and Paper Mills (Catalog No. 36-204—annual)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

PULP & PAPER Project Report (monthly, with semiannual Mill-by-Mill Listings supplement)
Miller Freeman Publication
500 Howard St., San Francisco, Calif. 94105

Pulp and Paper/Quarterly Statistics (quarterly)
OECD/Organization for Economic Cooperation
and Development, Paris, France
OECD Publications Center
1750 Pennsylvania Ave. N.W.
Washington, D.C. 20006

PULP & PAPER WEEK (weekly—48 times a year)
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulp, Paper and Paperboard Industry: Profits, Future Development & Investment Risk, a Global Scenario (1982)
Compiled by Euro-Data Analysts, U.K.
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Pulpwood and Wood Residue Statistics (Catalog No. 25-001—monthly)
Statistics Canada
Publications Distribution, User Services Div.
Ottawa, Ont. K1A 0T6, Canada

Recognition Rankings of suppliers to the pulp and paper industry (biennial)
PULP & PAPER, Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Reference Tables (annual)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9, Canada

SOS/Sources of Supply Buyers Guide (annual)
Advertisers & Publishers Service Inc.
300 N. Prospect Ave., Park Ridge, Ill. 60068

Short-term Review of International Pulp & Paper Markets, Worldwide (quarterly)
Jaakko Poyry Consulting Oy
Box 16, SF-00401 Helsinki 40, Finland

Solid Waste Management and the Paper Industry (1979)
Report by Franklin Associates Ltd. and
International Research & Technology Corp.
for Solid Waste Council of Paper Industry
c/o American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Southern Pulp & Paper (monthly except twice in Oct.)
Ernest H. Abernethy Publishing Co. Inc.
75 Third St. N.W., Atlanta, Ga. 30308

Specialty Papers and Board Trends and Developments (1978)
Data-Transcripts
90 High St., Wingham, Kent CT3 1DE, U.K.

Specialty Papers and Products Record (monthly)
Data-Transcripts
90 High St., Wingham, Kent CT3 1DE, U.K.

Statistical Bulletin (monthly)
Canadian Pulp & Paper Assn.
2300 Sun Life Bldg., Montreal, Que. H3B 2X9, Canada

Statistical Bulletin/Containerboard Shipments, Consumption, Inventory (monthly)
Fibre Box Assn.
5725 E. River Rd., Chicago, Ill. 60631

Statistics of Paper and Paperboard (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

Survey of Pollution Control Expenditures (26 major industries—annual)
McGraw-Hill Economics Dept.
1221 Ave. of the Americas, New York, N.Y. 10020

Survey of U.S. Business' Plans for New Plants and Equipment (26 major industries—twice yearly)
McGraw-Hill Economics Dept.
1221 Ave. of the Americas, New York, N.Y. 10020

Synthetics and Plastics Paper (1972-74)
Wolpert & Jones (Studies) Ltd.
26 St. John's Rd., London, U.K. NW11 0PG

Tappi (monthly)
TAPPI (Technical Assn. of Pulp & Paper Industry)
1 Dunwoody Pk., Atlanta, Ga. 30338

TAPPI Directory (annual)
TAPPI (Technical Assn. of Pulp & Paper Industry)
1 Dunwoody Pk., Atlanta, Ga. 30338

Trademarks, Sanitary Tissue and Disposable Products (1980)
American Paper Institute, Tissue Div.
260 Madison Ave., New York, N.Y. 10016

Transport and Handling in the Pulp and Paper Industry, Vol. 1 (1975)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Transport and Handling in the Pulp and Paper Industry, Vol. 2 (1977)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Transport and Handling in the Pulp and Paper Industry, Vol. 3 (1979)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Transport and Handling in the Pulp and Paper Industry, Vol. 4 (1981)
Edited by PULP & PAPER INTERNATIONAL
Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

U.S. Exports, Schedule E, Commodity by Country (Catalog FT 410—monthly)
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

U.S. Exports of Pulp, Paper, Paperboard and Converted Products (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

U.S. Exports of Wastepaper by Destination (annual)
American Paper Institute
260 Madison Ave., New York, N.Y. 10016

U.S. Imports, Schedule A, Commodity by Country (Catalog FT 135—monthly)
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

U.S. Woodpulp Data (monthly)
American Paper Institute
Pulp, Materials & Technology Group
260 Madison Ave., New York, N.Y. 10016

Walden's ABC Guide and Paper Production Yearbook (annual)
Walden-Mott Corp.
466 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Fiber & Board Report (semimonthly)
Walden-Mott Corp.
466 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Handbook/For Paper Salespeople and Buyers (second edition, 1981)
Walden-Mott Corp.
466 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Paper Catalog (2 times a year, in 6 regional editions)
Walden-Mott Corp.
466 Kinderkamack Rd., Oradell, N.J. 07649

Walden's Paper Report (twice monthly)
Walden-Mott Corp.
466 Kinderkamack Rd., Oradell, N.J. 07649

Wood Pulp & Fiber Statistics (annual)
American Paper Institute
Pulp, Materials & Technology Group
260 Madison Ave., New York, N.Y. 10016

SPECIAL REPORTS AND SURVEYS (generally priced at least $1000)

Absorbent Products Market, Part I: Competition in Markets for Baby Diapers, Feminine Pads and Tampons (1981)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Absorbent Products Markets, Part II: Adult Incontinent Products (1982)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Air Laid Forming in the 80s for Grades Containing Wood Pulps (1980)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Business Forms Market (1979)
Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Coated Paper Market (1980)
Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Commercial Tissue Technology & Marketing (1978)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Demand and Supply of Papermaking Fibers; Worldwide (2 volumes, 1976-77)
Arne Sundelin AB
Box 130, S-181 Lidingö, Sweden

Developing Markets for Paper Containing Synthetic Pulps and Fibers, a Critical Analysis (1980)
R M Associates
151 E. Forest Ave., Neenah, Wis. 54956

Dielectric Coated Paper: a Technology and Market Update (1979)
Gorham International
P.O. Box 8, Gorham, Maine 04038

Energy Conservation Potential and Alternatives in the Pulp and Paper Industry (1977)
Gorham International
P.O. Box 8, Gorham, Maine 04038

Financial Performance of Major Forest Product Companies in Western Europe and North America (1982)
Jaakko Poyry International
P.O. Box 16, SF-00401 Helsinki 40, Finland

Fine Papers: Markets, Products and the Future (1982)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 49007

Impactless Printing: Status and Projected Growth, with Special Emphasis on Paper Requirements, Characteristics and Volumes (1978)
Gorham International
P.O. Box 8, Gorham, Maine 04038

Kraft Paper versus Polyolefins: Comparative Cost Analysis, 1976-1981-1986 (1977)
Springborn Laboratories Inc.
Enfield, Conn. 06082

Mechanical Pulping in Transition: Opportunities and Threats for the Chemical Supplying Companies (1981)
Gorham International
P.O. Box 8, Gorham, Maine 04038

Nonwoven Disposable Products (1977)
Predicasts Inc.
11001 Cedar Ave., Cleveland, Ohio 44106

Non-woven Products Market in the U.S. (1979)
Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Outlook for the Forest Products Industry 1978-1988 (1979)
Arthur D. Little Inc.
Acorn Park, Cambridge, Mass. 02140

Outlook for U.S. Nonwoven Product Markets to 1982 (1978)
Arthur D. Little Inc.
Acorn Park, Cambridge, Mass. 02140

Outlook for World's Forest Products (1979)
SRI International
333 Ravenswood Ave., Menlo Park, Calif. 94025

Paper and Forest Products (annual)
Paine Webber Mitchell Hutchins Inc.
One Battery Park Plaza, New York, N.Y. 10004

Paper Demand to 1990; Worldwide (2 volumes, 1976)
Arne Sundelin AB
Box 130, S-181 21 Lidingö, Sweden

Paper Machine Reports
Jaakko Poyry International
P.O. Box 16, SF-00401 Helsinki 40, Finland

Paper, Paperboard and Associated Machinery in Europe (1979)
Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Paper vs Plastics (1977)
Predicasts Inc.
11001 Cedar Ave., Cleveland, Ohio 44106

Plastics vs Paper (1980)
Business Communications Co. Inc.
P.O. Box 2070C, Stamford, Conn. 06906

Pulp Mill Reports
Jaakko Poyry International
P.O. Box 16, SF-00401 Helsinki 40, Finland

Supply and Demand for Papermaking Fibres (1982)
Jaakko Poyry International
P.O. Box 16, SF-00401 Helsinki 40, Finland

U.S. Wipe and Towel Markets—Nonwoven and Paper (1980)
Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 40997

World Paper and Board to 1990 (1978)
Predicasts Inc.
11001 Cedar Ave., Cleveland, Ohio 44106

World Paper Demand and Supply (5 volumes:
I. Western Europe and North America;
II. Latin America; III. Africa;
IV. Asia and Oceania; V. Centrally Planned Economies—
available in worldwide or regional editions, 1982)
Jaakko Poyry International
P.O. Box 16, SF-00401 Helsinki 40, Finland

World Wood Pulp and other Fibrous Materials (1980)
Predicasts Inc.
11001 Cedar Ave., Cleveland, Ohio 44106

SPECIAL MARKET REPORTS (list on request to publishers)

BIS Marketing Research Ltd.
York House, 199 Westminstser Bridge Rd.
London SE1 7UT, England

Data Resources Inc., Forest Products Div.
29 Hartwell Ave., Lexington, Mass. 02173

Euro-Data Analysts
7 Priors, Ashtead, Surrey KT21 2QF, U.K.

Miller Freeman Publications
500 Howard St., San Francisco, Calif. 94105

Frost & Sullivan Inc.
106 Fulton St., New York, N.Y. 10038

Gorham International Inc.
P.O. Box 8, Gorham, Maine 04038

Leonard Guss Associates Inc.
4041 Ruston Way, Tacoma, Wash. 98402

International Resource Development Inc.
30 High St., Norwalk, Conn. 06851

A. D. Little Inc.,
Acorn Park, Cambridge, Mass. 02140

Marketing/Technology Service
3125 W. Main St., Kalamazoo, Mich. 496007

Omega Associates International
5604 Baum Blvd., Pittsburgh, Pa. 15206

Jaakko Poyry International
P.O. Box 16, SF-00401 Helsinki 40, Finland

Predicasts Inc.
11001 Cedar Ave., Cleveland, Ohio 44106

R M Associates
151 E. Forest Ave., Neenah, Wis. 54956

SRI International
333 Ravenswood, Ave., Menlo Park, Calif. 94025

Strategic Business Services Inc.
4320 Stevens Creek Blvd., San Jose, Calif. 95129

COMPANY PROFILES

This section is a directory of all pulp- and papermaking facilities in United States and Canada. It is divided into two parts:

MAJOR FIRMS (1000-tpd capacity)

Included in these listings are companies with daily production capacity of at least 1000 short tons (or 900 metric tons) of pulp and paper combined. All pulp produced at a millsite, whether shipped as market pulp or consumed onsite in papermaking, is counted.

Sales and earnings figures for 1980 and 1981 are given (where available) and a brief financial description of each company is presented. All pulp and paper/board production sites are listed, showing grades and capacity.

Operations are listed under the name of the corporate owner. Subsidiaries and joint ventures in U.S. and Canada are included under the parent firm. Foreign operations are not listed.

ALL-INCLUSIVE INDUSTRY GUIDE

This section presents production capacity and financial data (where available) on all U.S. and Canadian pulp and paper firms. Operations are listed under the corporate owner.

Subsidiary companies and joint ventures are cross-referenced. All companies in 'Major Firms (1000-tpd capacity)' listings are cross-referenced.

FINANCIAL DATA

All sales and earnings figures are shown in U.S. dollars, unless indicated 'C$' for Canadian dollars.

PRODUCTION DATA

All capacity production data are in short tons of 2000 lb, unless specifically indicated as metric.

To convert to metric tons:
multiply by 0.90718

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COMPANY PROFILES
Major firms (1000 tpd capacity)

A listing of U.S. and Canadian companies with daily production capacity of 1000 short tons or more, counting facilities for pulp, paper and paperboard, and building board grades.

Abitibi-Price Inc.

Toronto-Dominion Centre
Toronto, Ont. M5K 1B3
Robert C. Gimlin, president/chief executive officer

(Joint ventures: Gaspesia Pulp & Paper Co. Ltd., a subsidiary of Price, 51%; Augusta Newsprint Co., 50%)

Net sales (C$):	
1981	$1,763,385,000
1980	1,364,695,000
Net earnings (C$):	
1981	119,641,000*
1980	90,607,000*

*After extraordinary items

In 1981 Abitibi sold its Thorold, Ont., fine paper mill to Fraser Inc.; transferred the newsprint operations at Augusta, Ga., to a joint-venture partnership with Thomson Newspapers Ltd.; became majority-owned (approximately 93%) by Olympia & York Developments Ltd.; and started up the newsprint mill (converted from linerboard) in Stephenville, Nfld.

Paper production at Abitibi mills in 1981 totaled 2,363,000 metric tons, of which 1,857,000 tons were newsprint and 308,000 tons uncoated groundwood grades; the balance was fine paper and kraft grades. Market pulp output was 144,000 tons. Paper, board and converted products accounted for 89.1% of 1981 sales.

Major capital spending programs include the new newsprint machine at Augusta, Ga.; conversion of Beaupré, Que., mill from newsprint to groundwood papers; pulp conversion programs at Grand Falls, Nfld., from refiner mechanical to thermomechanical, and from sulfite to a high-yield process; modernization, including new newsprint machine, at Iroquois Falls, Ont.

Abitibi owns or has cutting rights on 42,168 square miles (approximately 27 million acres) of timberland in Canada and U.S.

Production facilities:

AUGUSTA, GA.
(Augusta Newsprint)
Pulp—500 short tpd groundwood
Newsprint—475 short tpd

DeRIDDER, LA.
(Boise Southern)
Newsprint—235 short tpd (Abitibi's share)

ALPENA, MICH.
(Abitibi-Price Corp.)
Hardboard—330,000,000 ft^2/yr (400 tpd)

ROARING RIVER, N.C.
(Abitibi-Price Corp.)
Pulp—345 short tpd defibrated (refined)
Hardboard—165,000,000 ft^2/yr

PINE FALLS, MAN.
Pulp—136 metric tpd sulfite; 408 tpd groundwood
Newsprint—472 metric tpd

GRAND FALLS, NFLD.
(Price (Nfld) Pulp & Paper)
Pulp—209 metric tpd sulfite; 680 tpd refiner mechanical
Newsprint—860 metric tpd

STEPHENVILLE, NFLD.
(Stephenville Div.)
Pulp—544 metric tpd thermomechanical
Newsprint—399 metric tpd

GEORGETOWN, ONT.
(Abitibi-Price Fine Papers)
Printing/writing papers—45 metric tpd

IROQUOIS FALLS, ONT.
Pulp—245 metric tpd sulfite, 762 tpd groundwood
Newsprint—862 metric tpd; wrapper—41 tpd

SAULT STE. MARIE, ONT.
Pulp—318 metric tpd groundwood
Groundwood specialty papers—376 metric tpd

SMOOTH ROCK FALLS, ONT.
Pulp—286 metric tpd kraft (for market)

THUNDER BAY, ONT.
(Abitibi-Price Fine Papers)
Pulp—61 metric tpd groundwood
Printing/writing papers—318 metric tpd

THUNDER BAY, ONT.
(Fort William Div.)
Pulp—136 metric tpd CRMP; 299 tpd groundwood
Newsprint—336 metric tpd

THUNDER BAY, ONT.
(Thunder Bay Div.)
Pulp—136 metric tpd sulfite; 408 tpd groundwood
Newsprint—426 metric tpd

ALMA, QUE.
(Price Co.)
Pulp—218 metric tpd sulfite; 708 tpd groundwood
Newsprint—762 metric tpd

BEAUPRE, QUE.
Pulp—136 metric tpd sulfite; 318 tpd groundwood; 54 tpd thermomechanical
Newsprint—395 metric tpd

CHANDLER, QUE.
(Gaspesia Pulp & Paper Co.)
Pulp—136 metric tpd sulfite; 408 groundwood; 36 tpd refiner mechanical
Newsprint—617 metric tpd

JONQUIERE, QUE.
(Price/Kenogami groundwood)
Pulp—299 metric tpd groundwood; 327 tpd thermochemimechanical (TCMP)
Groundwood specialty papers—703 metric tpd

JONQUIERE, QUE.
(Price kraft)
Pulp—172 metric tpd kraft (54 tpd for market)
Paperboard—150 metric tpd

LaCHUTE, QUE.
(Price Wilson)
Packaging, toweling papers—19 metric tpd

Total production capacity:

PULP	
Defibrated	708 metric tpd
Groundwood	4452 metric tpd
Kraft	458 metric tpd
CRMP	136 metric tpd
Refiner mechanical	717 metric tpd
Sulfite	1216 metric tpd
TCMP	327 metric tpd
Thermomechanical	54 metric tpd
Total	8068 metric tpd
PAPER & BOARD	
Newsprint	5702 metric tpd
Groundwood spec.	1080 metric tpd
Printing/writing	341 metric tpd
Packaging/wrapper	60 metric tpd
Paperboard	150 metric tpd
Total	7333 metric tpd
BUILDING BOARD	
Hardboard	588 metric tpd

Allied Paper Inc.

2030 Portage St.
Kalamazoo, Mich. 49003
Ernest J. Klimczak, president/chief executive officer

(Sub. of SCM Corp.)

Net sales:	
1981	$322,200,000
1980	297,000,000
Operating income:	
1981	40,900,000
1980	46,700,000

Allied Paper had its second-best year in 1981 (ending June 30), with record sales and profits reported by the pulp group. The Jackson, Ala., mill produced a record 200,000 tons of pulp, about half used in papermaking and half sold on the market. Paper operating income was down in 1981. Results reported for Allied's paper group include operations and sales for converted products.

In 1981, Allied acquired M.W. Smith Lumber Co., near the Jackson, Ala., mill, which will provide additional chip supplies. The Monarch mill in Kalamazoo, Mich., was shut down and dismantled.

Capital expenditures for paper products group were $17,284,000.

Production facilities:

JACKSON, ALA.
Pulp—600 tpd kraft (about 50% for market)
Printing/writing paper—225 tpd

KALAMAZOO, MICH.
Printing/writing & specialty—300 tpd

Total production capacity:

PULP	600 tpd
PAPER	525 tpd

Alton Packaging Corp.

401 Alton St.
Alton, Ill. 62002
Michael W.J. Smurfit, president/chief executive officer

(Owned by Jefferson Smurfit Group Ltd.)

Net sales:	
1981	$362,000,000
1980	334,000,000
Net earnings:	
1981	9,500,000*
1980	7,800,000*

*Extraordinary charge

In late-1981 the Ireland-headquartered multinational Jefferson Smurfit Group completed acquisition of Alton.

First phase of a major program at the Jacksonville mill is a new coal/bark-fired power boiler, targeted for mid-1983 completion. Cost of the project is $54,000,000.

Production facilities:

JACKSONVILLE, FLA.
Pulp—725 tpd kraft
Unbleached kraft paperboard—775 tpd

CEDARTOWN, GA.
Tube stock board—50 tpd

ALTON, ILL.
Recycled linerboard, corrugating medium—600 tpd

LAFAYETTE, IND.
Tube stock, chipboard—100 tpd

Total production capacity:

PULP	
Kraft	725 tpd
PAPER & BOARD	
Unbleached kraft board	775 tpd
Recycled containerboard	600 tpd
Tube stock, chipboard	150 tpd
Total	1525 tpd

Appleton Papers Inc.

Box 359
Appleton, Wis. 54912
John J. Hangen, chairman/chief executive officer

(Subsidiary and paper division of BATUS Inc. of U.S., in turn a subsidiary of B.A.T Industries of U.K.)

Sales/revenues:	
1981	$403,200,000
1980	367,600,000
Operating income	
1981	36,900,000
1980	39,000,000

Production facilities:

ROARING SPRING, PA.
Pulp—180 tpd bleached kraft
Carbonless paper—180 tpd

COMBINED LOCKS, WIS.
Pulp—200 tpd chemimechanical
Carbonless & directory paper—445 tpd

Total production capacity:

PULP	
Kraft	180 tpd
Chemimechanical	200 tpd
Total	380 tpd
PAPER	
Carbonless & directory	625 tpd

BC Timber Ltd.

1176 West Georgia St.
Vancouver, B.C. V6E 4B7
John S.R. Montgomery, president

(Subsidiary of B.C. Resources Investment Corp.; includes forest products operations of former Canadian Cellulose Co. Ltd. (pulp mills) and Kootenay Forest Products Ltd. and Plateau Mills Ltd.)

Net sales (C$):	
1981	$336,400,000
1980	385,300,000
Operating profit (C$):	
1981	−11,200,000
1980	45,100,000

Production at BC Timber pulp mills in 1981 was 409,000 metric tons compared to 480,000 tons in 1980. A six-week strike interrupted output and shipments, and contributed to the operating loss. Pulp sales of BC Timber in 1981 were $228,500,000, down from $260,300,000 in 1980, but representing two-thirds of 1981 sales total.

Capital spending in 1981 was $C39,000,000, of which $25,000,000 was for the profitability/energy improvement program at Prince Rupert. At completion in mid-1982, this program brings Prince Rupert's capacity to 1220 metric tpd.

BC Timber controls 4,700,000 acres of timberland.

Production facilities:

CASTLEGAR, B.C.
(Celgar Pulp Div.)
Pulp—525 metric tpd

PRINCE RUPERT, B.C.
(Skeena Pulp Div.)
Pulp—1220 metric tpd

Total production capacity:

PULP	1745 metric tpd

Bato Co. Inc.

50 Chestnut St.
Byram, Conn. 06830
Murray Brant, chairman

(Wholly-owned subsidiary is F.F. Soucy Inc., which is a joint owner of F.F. Soucy Inc. et Associés along with Dow Jones and Rexfor; through its Brant-Allen Industries affiliate, Bato is a joint owner of Bear Island Paper along with Dow Jones and Washington Post).

Financial data not available.

Production facilities:

DOSWELL, VA.
(Bear Island Paper Co.)
Pulp—500 tpd thermomechanical
Newsprint—500 tpd

RIVIERE DU LOUP, QUE.
(F.F. Soucy Inc.)
Pulp—127 metric tpd refiner mechanical, 454 tpd thermomechanical
Newsprint—127 metric tpd

RIVIERE DU LOUP, QUE.
(F.F. Soucy Inc. et Associés)
Newsprint—454 metric tpd

Total production capacity:

PULP (short tons)	
Thermomechanical	1000 tpd
Refiner mechanical	140tppd
Total	1140 tpd
PAPER (short tons)	
Newsprint	1140 tpd

Boise Cascade Corp.

One Jefferson Sq.
Boise, Idaho 83728
John B. Fery, chairman/chief executive officer

(Boise owns Boise Cascade Canada Ltd. and 50% of Boise Southern Co.)

Net sales:	
1981	$3,107,360,000
1980	3,018,940,000
Net earnings:	
1981	120,080,000
1980	147,940,000*

*After extraordinary gain

Boise pulp/paper/board facilities produced 2,174,000 short tons at 14 mills in U.S. and Canada in 1981; an additional 721,000 tons were produced at joint-venture mills.

Sales of paper in 1981 were $1,221,000,000, 36% of corporate total, but operating income of $207,000,000 represented 82% of total. Of the 12,159,000 tons sold in 1981, printing/publication papers accounted for 1,285,000 tons, newsprint was 434,000 tons, and market pulp was 272,000 tons. Sales from the Boise Southern joint venture were 720,000 tons of kraft paper/board and newsprint.

Paper Group capital expenditures for property and equipment were $78,500,000 in 1981.

Boise owns and/or controls 6,568,000 acres of timberland in U.S. and Canada.

Production facilities:
(U.S. sites in short tons; Canada in metric)

ELIZABETH, LA.
(Mill idle)

DeRIDDER, LA.
(Boise Southern)
Pulp—1050 tpd unbleached kraft, 180 tpd bleached kraft, 480 tpd groundwood, 450 tpd TMP
Linerboard—1070 tpd
Newsprint—1000 tpd

RUMFORD, MAINE
Pulp—650 tpd bleached kraft, 120 tpd TMP, 120 tpd groundwood
Printing/publishing—1005 tpd

INTERNATIONAL FALLS, MINN.
Pulp—365 tpd unbleached kraft (335 tpd bleached)
Printing/publishing paper—520 tpd

INTERNATIONAL FALLS, MINN.
(Wood Products)
Pulp—540 tpd refiner mechanical
Fiberboard insulation—500 tpd

BEAVER FALLS, N.Y.
(Specialty Paperboard Div.—two mills)
Pulp—60 tpd refiner mechanical
Paperboard—99 tpd specialty grades

BROWNVILLE, N.Y.
(Specialty Paperboard Div.)
Paperboard—65 tpd specialty grades

ST HELENS, ORE.
(Specialty Kraft & Fine Paper Div.)
Pulp—1000 tpd bleached kraft (some for market)
Specialty & fine papers—625 tpd

SALEM, ORE.
(Mill manufacturing facilities idle)

BRATTLEBORO, VT.
(Specialty Paperboard Div.)
Paperboard—85 tpd specialty grades

STEILACOOM, WASH.
Pulp—480 tpd thermomechanical
Newsprint—500 tpd

VANCOUVER, WASH.
(Fine Papers Div.)
Printing/publishing—300 tpd

WALLULA, WASH.
Pulp—690 tpd bleached kraft (some for market), 220 tpd semichemical
Containerboard—275 tpd
Printing/publishing—400 tpd

NEWCASTLE, N.B.
(Boise Cascade Canada)
Pulp—440 metric tpd kraft (for market)

FORT FRANCES, ONT.
(Boise Cascade Canada)
Pulp—558 metric tpd groundwood, 470 tpd kraft (some for market)
Groundwood specialty papers—575 metric tpd

KENORA, ONT.
(Boise Cascade Canada)
Pulp—530 metric tpd groundwood, 227 tpd sulfite
Newsprint—690 metric tpd

Total production capacity:

PULP (short tons)	
Kraft	5090 tpd
Groundwood	1745 tpd
Thermomechanical	1050 tpd
Refiner mechanical	600 tpd
Sulfite	250 tpd
Semichemical	220 tpd
Total	8355 tpd
PAPER & BOARD (short tons)	
Newsprint	2260 tpd
Groundwood specialty	635 tpd
Printing/publishing	2850 tpd
Containerboard	1345 tpd
Specialty paperboard	249 tpd
Total	7339 tpd
BUILDING BOARD	
Hardboard/fiberboard	500 tpd

Bowater North America Corp.

1500 E. Putnam Ave.
Old Greenwich, Conn. 06870
Hugh K. Joyce, president/chief executive officer

(Bowater North America provides management services for Bowater's interests in North America. The new Pulp and Paper Group in Greenville, S.C., is a profit center for the four major pulp/paper mills and their related operations. Bowater Southern and Bowater Carolina are divisions; Catawba Newsprint is a subsidiary; Bowater Canadian is the holding company for Bowater Mersey, Bowater Newfoundland, and Perkins Papers.)

Bowater North America sales in 1981 were around U.S.$836,000,000, up from $603,000,000 in 1980 (converted at $1.85 per Brit £.) Trading profit for Bowater North America was about $194,000,000 in 1981, and $150,000,000 in 1980.

Production facilities:

(U.S. sites in short tons; Canada in metric)

CATAWBA, S.C.
(Bowater Carolina Co.)
Pulp—1100 tpd kraft (1050 tpd bleached; 650 tpd for market), 100 tpd TMP, 150 tpd groundwood
Coated publication paper—300 tpd

CATAWBA, S.C.
(Catawba Newsprint Co.)
Pulp—500 tpd groundwood
Newsprint—600 tpd

CALHOUN, TENN.
(Bowater Southern Paper Co.)
Pulp—520 tpd semibleached kraft, 820 tpd groundwood, 200 tpd cold soda, 405 tpd thermomechanical
Newsprint—1900 tpd

CORNER BROOK, NFLD.
(Bowater Newfoundland Ltd.)
Pulp—315 metric tpd sulfite, 615 tpd groundwood, 405 tpd TMP
Newsprint—1000 metric tpd

LIVERPOOL, N.S.
(Bowater Mersey Paper Co.)
Pulp—360 metric tpd groundwood, 180 tpd TMP, 145 tpd sulfite
Newsprint—480 metric tpd

CANDIAC, QUE.
(Perkins Paper Ltd.)
Pulp—150 metric tpd deinked
Tissue and towel—73 metric tpd

Total production capacity:

PULP (short tons)	
Cold soda	200 tpd
Kraft	1620 tpd
Groundwood	2570 tpd
Sulfite	510 tpd
Thermomechanical	1155 tpd
Deinked	150 tpd
Total	6205 tpd

PAPER (short tons)	
Coated publication	300 tpd
Newsprint	4120 tpd
Tissue and towel	80 tpd
Total	4500 tpd

British Columbia Forest Products Ltd.

1050 W. Pender St.
Vancouver, B.C. V6E 2X3
Kenneth P. Benson, president/chief executive officer

(BCFP owns Blandin Paper Co. in U.S.; 45% of Donohue St-Felicien Inc.; 42.7% of Finlay Forest Products Industries Ltd.; 33.3% of Western Forest Products Ltd. Alberta Energy Co. Ltd. has a 28% interest in BCFP; Brunswick Pulp & Paper a 26% interest, and Mead Corp. 15%.)

Net sales (C$):	
1981	$815,000,000
1980	850,307,000
Net earnings (C$):	
1981	17,187,000
1980	60,530,000

Production and earnings of BCFP in 1981 were affected by the six-week strike in British Columbia. Production of newsprint was 236,000 metric tons, market pulp was 403,000 tons; coated paper at Blandin in U.S. was 291,000 short tons. Sales of paper in 1981 accounted for C$335,700,000 and sales of pulp were $210,000,000; together 67% of corporate sales.

Major capital spending programs at Crofton and in Alberta through 1986 are estimated to be C$450,000,000. By end-1981 BCFP had spent $146,000,000 on these programs and expected to spend $39,000,000 in 1982. At Crofton, a new newsprint machine was due for mid-1982 startup; in Alberta, the first sawmill at Grande Cache of the proposed forest products complex started up in spring 1982.

Production facilities:

GRAND RAPIDS, MINN.
(Blandin Paper Co.)
Pulp—180 air-dry short tpd thermomechanical; 175 tpd groundwood
Groundwood printing papers—875 short tpd

CROFTON, B.C.
(Crofton Pulp & Paper Div.)
Pulp—1020 metric tpd kraft (for market), 508 tpd groundwood
Newsprint and specialty papers—780 metric tpd

MACKENZIE, B.C.
(Mackenzie Div.)
Pulp—560 metric tpd kraft (for market)

ST-FELICIEN, QUE.
(Donohue St-Felicien Inc.)
Pulp—690 metric tpd bleached kraft (BCFP's share: 310 tpd)

Total production capacity:

PULP	
Kraft	1890 metric tpd
Groundwood	667 metric tpd
Thermomechanical	163 metric tpd
Total	2720 metric tpd

PAPER	
Newsprint	780 metric tpd
Groundwood printing	794 metric tpd
Total	1574 metric tpd

CIP Inc.

1155 Metcalfe St.
Montreal, Que. H3B 2X1
C.S. Flenniken, president/chief executive officer

(Former Canadian International Paper Co. was sold in 1981 to Canadian Pacific Enterprises Ltd., in turn owned 71% by CP Ltd., Canada's largest company. CP Enterprises also owns 54% of Great Lakes Forest Products. A one-third interest in the New Brunswick mill was acquired in 1980 by Oji Paper and Mitsui of Japan.)

No financial data is available.

A major modernization/expansion program is underway at the Dalhousie, N.B., mill, which will add 270 metric tpd to newsprint capacity by end-1982; also add about 375 tpd of CIP's patented SCMP pulp, and eventually replace existing chemical pulp production.

Production facilities:

GOLD RIVER, B.C.
(Tahsis Co. Ltd., 50% equity)
Pulp—750 metric tpd kraft (for market)

DALHOUSIE, N.B.
(NBIP Ltd.)
Pulp—220 metric tpd sulfite, 600 tpd groundwood; 376 tpd New Process (SCMP) pulp
Newsprint—790 metric tpd
Mill wrapper—30 metric tpd

HAWKESBURY, ONT.
Pulp—260 metric tpd sulfite (for market)

TORONTO, ONT.
(Dominion Cellulose Ltd.)
Tissue and towel—265 metric tpd

GATINEAU, QUE.
Pulp—450 metric tpd stone groundwood, 600 tpd refiner groundwood, 380 tpd New Process (SCMP) pulp
Newsprint—1400 metric tpd

LA TUQUE, QUE.
Pulp—1450 metric tpd kraft (460 tpd for market)
Kraft paperboard—697 metric tpd
Solid bleached board—283 metric tpd

MATANE, QUE.
Pulp—250 metric tpd semichemical
Semichemical corrugating medium—250 metric tpd

TROIS RIVIERES, QUE.
Pulp—240 metric tpd sulfite, 680 tpd groundwood
Groundwood specialties—900 metric tpd; paperboard—30 tpd

Total production capacity:

PULP	
Kraft	2200 metric tpd
Groundwood	1730 metric tpd
New process (SCMP)	756 metric tpd
Refiner groundwood	600 metric tpd
Semichemical	250 metric tpd
Sulfite	720 metric tpd
Total	6256 metric tpd
PAPER & BOARD	
Newsprint	2190 metric tpd
Groundwood spec.	900 metric tpd
Wrapper	30 metric tpd
Tissue/towel	265 metric tpd
Solid bleached board	283 metric tpd
Unbleached board	727 metric tpd
Semichemical board	250 metric tpd
Total	4645 metric tpd

Canadian Forest Products Ltd.

2800-1055 Dunsmuir St.
Vancouver, B.C. V7X 1B5
P.J.B. Bentley, president/chief executive officer

(Wholly owns Prince George Pulp & Paper Ltd.; and 75% of Intercontinental Pulp Co. Ltd.)

Canadian Forest Products is privately owned and issues no financial data.

Production of market pulp in 1981 was 398,000 metric tons, and 95,000 tons of paper/board. Both products were affected by a six- to eight-week strike as well as soft markets.

A major expansion/modernization program is underway at the Howe Sound pulp mill, designed to increase output to 585 tpd by 1985. In June 1981, the mill achieved an average daily production rate of 552.5 tons—a new all-time high.

Production facilities:

NEW WESTMINSTER, B.C.
(Plywood & Hardboard Div.)
Pulp—180 metric tpd defibrated
Hardboard—180 metric tpd

PORT MELLON, B.C.
(Howe Sound Pulp Div.)
Pulp—505 metric tpd kraft (for market)

PRINCE GEORGE, B.C.
(Intercontinental Pulp Co.)
Pulp—690 metric tpd (for market)
(Canfor's 75% share 517 tpd)

PRINCE GEORGE, B.C.
(Prince George Pulp & Paper)
Pulp—680 metric tpd kraft (390 tpd for market)
Sack paper—290 metric tpd

Total production capacity:

PULP	
Kraft	1702 metric tpd
Defibrated	180 metric tpd
Total	1882 metric tpd
PAPER	
Sack	290 metric tpd
BUILDING BOARD	
Hardboard	180 metric tpd

Celotex Corp.

Box 22601
Tampa, Fla. 33622
Frank Burgen, executive vice president, Celotex

(Sub. of Jim Walter Corp.)

Celotex operates within the Mineral & Fiber Products Group of Jim Walter Corp., and is further divided into three operating units: Roofing Products, Building Products, and Industrial Products.

Sales of Mineral & Fiber Products group in fiscal 1981 (ended Aug. 31, 1981) were $637,137,000, 31% of corporate total. Contributions to income were −$2,498,000.

Production facilities:

CAMDEN, ARK.
Roofing felt—35 tpd

LOS ANGELES, CALIF.
Roofing felt—55 tpd

PEORIA, ILL.
Pulp—90 tpd defibrated
Roofing felt—230 tpd

QUINCY, ILL.
Gypsum board liner—275 tpd

WILMINGTON, ILL.
Pulp—30 tpd defibrated
Roofing felt—70 tpd

DUBUQUE, IOWA
Pulp—250 tpd defibrated
Insulation board—250 tpd

MARRERO, LA.
Pulp—200 tpd bagasse
Insulation board—200 tpd

LINDEN, N.J.
Building paper/board—60 tpd

PERTH AMBOY, N.J.
Pulp—50 tpd defibrated
Roofing felt—100 tpd

DEPOSIT, N.Y.
Pulp—200 tpd defibrated
Medium-density fiberboard—200 tpd

GOLDSBORO, N.C.
Pulp—100 tpd defibrated
Roofing felt—100 tpd

PHILADELPHIA, PA.
Pulp—160 tpd
Roofing felt—140 tpd

SUNBURY, PA.
Pulp—90 tpd semichemical, 150 tpd defibrated
Building paper/board—240 tpd

MARION, S.C.
Pulp—360 tpd defibrated
Medium-density fiberboard—360 tpd

PARIS, TENN.
Pulp—300 tpd defibrated
Hardboard—300 tpd

HOUSTON, TEXAS
Pulp—25 tpd defibrated
Roofing felt—50 tpd

SAN ANTONIO, TEXAS
Roofing felt—45 tpd

Total production capacity:

PULP	
Defibrated	1715 tpd
Bagasse	200 tpd
Semichemical	90 tpd
Total	2005 tpd
BUILDING BOARD	
Roofing felt	825tpd
Building paper/board	1025 tpd
Hardboard	300 tpd
Medium-density fiberboard	560 tpd
Total	2710 tpd

Champion International Corp.

One Champion Plaza
Stamford, Conn. 06921
Andrew C. Sigler, chairman/chief executive officer

(Owns 73% of Weldwood of Canada, which in turn owns 50% of Cariboo Pulp & Paper)

Net sales:	
1981	$4,004,017,000
1980	3,752,718,000

Net earnings:	
1981	101,369,000
1980	147,068,000

Pulp, paper/board and converted products accounted for 60% of Champion's 1981 sales. Printing/writing papers brought in $1,100,000,000; bleached kraft market pulp sales were $79,000,000; kraft paperboard, paper and pulp, $114,000,000; converted products $1,170,000,000.

Total production of paper/board at Champion's U.S. and Canadian mills in 1981 was 4,643,400 short tons; pulp output was 2,383,000 tons.

Construction of a fourth paper machine at the major Courtland, Ala., mill is proceeding as planned; other major expansion programs have been slowed or deferred. Capital spending in 1981 was $149,000,000 and $178,000,000 is expected to be spent in 1982. Corporate capital spending program for 1981-85 period is approximately $2,400,000,000, focused two-thirds for expansion, primarily in the paper and packaging sectors.

Champion's timberland holdings in U.S. total 3,381,055 acres (3,027,350 acres owned; 353,705 acres controlled); and in Canada are 573,400 acres (58,400 acres owned; 515,000 acres controlled.)

Production facilities:

COURTLAND, ALA.
(Paper Division)
Pulp—1350 tpd kraft (some for market)
Uncoated and coated printing, writing and converting papers—1150 tpd

ONTONAGON, MICH.
(Packaging Division)
Pulp—500 tpd semichemical
Corrugating medium—550 tpd

ST. PAUL, MINN.
(Packaging Division)
Recycled medium—340 tpd
Combination (recycled) board—325 tpd

MISSOULA, MONT.
(Packaging Division)
Pulp—1920 tpd unbleached kraft
Linerboard—1920 tpd unbleached

CANTON, N.C.
(Paper Division)
Pulp—1400 tpd bleached kraft
Uncoated printing/writing and converting papers—850 tpd; bleached paperboard—700 tpd

ROANOKE RAPIDS, N.C.
(Packaging Division)
Pulp—1000 tpd unbleached kraft
Unbleached kraft paper—415 tpd
Unbleached linerboard—600 tpd

HAMILTON, OHIO
(Paper Division)
Uncoated and coated printing, writing & converting papers—440 tpd

HOOD RIVER, ORE.
(Building Products Division)
Hardboard (⅛ in.)—88,000,000 ft²/yr

LEBANON, ORE.
(Building Products Division)
Hardboard (⅛ in.)—116,000,000 ft²/yr

CATAWBA, S.C.
(Building Products Division)
Hardwood (⅛ in.)—237,000,000 ft²/yr

PASADENA, TEXAS
(Paper Division)
Pulp—760 tpd bleached kraft (some for market)
Uncoated and coated printing/writing and converting papers—690 tpd

QUESNEL, B.C.
(Cariboo Pulp & Paper Co., joint venture)
Pulp—375 metric tpd bleached kraft pulp (½ total capacity)

Total production capacity:

PULP (short tons)		
Bleached kraft		3910 tpd
Unbleached kraft		2920 tpd
Semichemical		500 tpd
Total	7330 tpd	

PAPER & BOARD (short tons)		
Fine papers—printing/writing & converting		3130 tpd
Milk/folding carton board		700 tpd
Unbleached linerboard		2520 tpd
Combination (recycled) board		325 tpd
Semichemical corrugating medium		550 tpd
Recycled medium		340 tpd
Unbleached kraft paper		415 tpd
Total	7980 tpd	

BUILDING BOARD
Hardboard 441,000,000 ft²/yr (515 tpd)

Chesapeake Corp. of Virginia

West Point, Va. 23181
J. Carter Fox, president/chief executive officer

Net sales:	
1981	$282,569,000
1980	257,807,000
Net earnings:	
1981	26,230,000
1980	23,445,000

Pulp, paper/board and converted products accounted for 90% of Chesapeake's sales in 1981. Production of paper and board was 394,000 tons; market pulp output was 115,000 tons; total output was in excess of 500,000 tons for the first time.

Chesapeake was completing in spring 1982 a five-year energy-oriented investment program to reduce energy costs and oil consumption. Spending in 1981 totaled $64,000,000, more than double the previous high.

Chesapeake owns 364,000 acres of timberland, of which 7200 acres were acquired in 1981.

Production facilities:

WEST POINT, VA.
Pulp—1300 tpd softwood and hardwood kraft (400 tpd bleached for market)
Paper—450 tpd
Paperboard—650 tpd

Total production capacity:

PULP	1300 tpd
PAPER & BOARD	1100 tpd

Consolidated-Bathurst Inc.

800 Dorchester Blvd.
W. Montreal, Que. H3B 1Y9
William I.M. Turner Jr., president/chief executive officer

(Owned 40% by Power Corp. of Canada)

Net sales (C$):	
1981	$1,491,303,000
1980	1,403,757,000
Net earnings (C$):	
1981	112,063,000*
1980	122,379,000

*Extraordinary items

Net sales of the Pulp and Paper Group in 1981 were C$791,600,000; operating profit was $173,000,000 (approximately 72% derived from newsprint and groundwood specialties). Shipments of newsprint in 1981 were 959,000 metric tons; pulp, 222,000 tons; containerboard, 289,000 tons; kraft paper and boxboard, 78,000 tons.

Production at the seven pulp/paper mills was 1,503,100 metric tons. Newsprint output was 910,390 tons, slightly higher than in 1980. Mainly because of reduced market demand, production of other grades was slightly below 1980 levels.

Capital expenditures in 1981 were $173,000,000; improvements to newsprint manufacturing facilities accounted for about 94%.

In 1981, Con-Bath acquired the Ellesmere Port newsprint mill of Bowater in England; it is being modified to make newsprint from chemithermomechanical pulp to be produced at the Bathurst mill.

In Canada, major capital projects have been underway at all the newsprint mills. A new directory paper machine started up in April at the Trois Rivières mill; twin-wire units are being added at Shawinigan and Ville de La Baie.

Production facilities:

BATHURST, N.B.
Pulp—154 metric tpd kraft (for market);

327 tpd semichemical
Corrugating medium—340 metric tpd

GRAND'MERE, QUE.
(Laurentide Div.)
Pulp—500 metric tpd groundwood, 136 tpd sulfite, 64 tpd refiner mechanical
Newsprint—630 metric tpd
Paperboard—100 metric tpd

NEW RICHMOND, QUE.
(Chaleurs Div.)
Pulp—612 metric tpd kraft
Linerboard—590 metric tpd

PORTAGE-DU-FORT, QUE.
(Pontiac Div.)
Pulp—590 metric tpd (for market)

SHAWINIGAN, QUE.
(Belgo Div.)
Pulp—820 metric tpd groundwood, 245 tpd sulfite
Newsprint—938 metric tpd

TROIS-RIVIERES, QUE.
(Wayagamack Div.)
Pulp—265 metric tpd kraft, 235 tpd groundwood
Newsprint—235 metric tpd
Kraft paper—218 metric tpd

VILLE DE LA BAIE, QUE.
(Port Alfred Div.)
Pulp—603 metric tpd groundwood, 195 tpd high-yield sulfite
Newsprint—934 metric tpd

Total production capacity:

PULP	
Kraft	1621 metric tpd
Semichemical	327 metric tpd
Groundwood	2158 metric tpd
Refiner mechanical	64 metric tpd
Sulfite	381 metric tpd
High-yield sulfite	195 metric tpd
Total	4746 metric tpd

PAPER	
Newsprint	2737 metric tpd
Linerboard	590 metric tpd
Corrugating medium	340 metric tpd
Kraft paper	218 metric tpd
Paperboard	100 metric tpd
Total	3985 metric tpd

Consolidated Papers Inc.

Box 50
Wisconsin Rapids, Wis. 54494
George W. Mead II, chairman/chief executive officer

Net sales:	
1981	$536,898,881
1980	510,288,519
Net earnings:	
1981	54,663,125
1980	52,573,472

Sales of pulp, paper/board and converted products comprised 89% of Consolidated's total in 1981.

Shipments of these products totaled 655,795 tons, of which 537,218 tons were enamel papers. Consolidated's capacity for production of enamel papers has reached 570,000 tons, with No. 64 machine now operating at and over design speed.

In 1981, Consolidated also shipped 47,428 tons of specialty papers, 6,092 tons of market pulp, 2,546 tons of paperboard and 62,511 tons of converted products.

Total production at Consolidated's six mills in 1981 was 702,542 tons of paper and paperboard and 317,457 tons of pulp.

Capital expenditures in 1981 were $35,539,000, and $45,346,000 is budgeted for 1982 spending. A major program, for 1983 completion, is installation of a new off-machine coater at Wisconsin Rapids Div., with proprietary Consolidated 63/64 blade-coating units.

Consolidated's timberland holdings comprise 305,318 acres owned in U.S. and 358,483 acres in Canada, with an additional 414,891 acres of controlled lands in Canada.

Production facilities:

APPLETON, WIS.
(Mill idle)

STEVENS POINT, WIS.
(Stevens Point Div.)
Specialty papers—125 tpd

STEVENS POINT, WIS.
(Wisconsin River Div.)
Pulp—230 tpd groundwood
Book papers—565 tpd

WISCONSIN RAPIDS, WIS.
(Wisconsin Rapids Div.)
Enamel papers—534 tpd
Paperboard—92 tpd

WISCONSIN RAPIDS, WIS.
(Biron Div.)
Pulp—308 tpd groundwood
Book papers—602 tpd

WISCONSIN RAPIDS, WIS.
(Kraft Div.)
Pulp—550 tpd kraft

Total production capacity:

PULP	
Groundwood	538 tpd
Kraft	550 tpd
Total	1088 tpd

PAPER & BOARD	
Book papers	1701 tpd
Specialty papers	125 tpd
Paperboard	92 tpd
Total	1918 tpd

Container Corp. of America

One First National Plaza
Chicago, Ill. 60603
Richard F. Tucker, president/chief executive officer

(Subsidiary of Mobil Corp.)

Net sales:	
1981	$1,821,000,000
1980	1,714,000,000
Operating earnings:	
1981	50,000,000
1980	65,000,000

Paperboard and converted products sales accounted for 95% of CCA's total in 1981.

On a worldwide basis, CCA's paperboard packaging production in 1981 was 2,482,000 tons, of which 52% comprised recycled paperboard. U.S. mills produced 1,849,000 tons, and foreign operations 633,000.

Capital spending at U.S. paperboard mills in 1981 was $161,000,000. Major conversions of oil-fired power plants to use of coal at both Fernandina Beach, Fla., and Brewton, Ala. were important recipients of capital funds.

In mid-1982, CCA signed an option agreement to purchase the 1000-tpd Eden recycled paperboard mill from bankrupt Whippany Paper Board Co., at Whippany, N.J.

CCA timberland holdings comprise 937,000 acres in U.S.

Production facilities:

BREWTON, ALA.
Pulp—1200 tpd kraft
Unbleached kraft board—675 tpd
Solid bleached board—475 tpd

SANTA CLARA, CALIF.
Combination (recycled) board—270 tpd

VERNON, CALIF.
Combination (recycled) board—400 tpd

FERNANDINA BEACH, FLA
Pulp—1400 tpd kraft, 300 tpd semichemical
Unbleached kraft board—1450 tpd
Semichemical corrugating medium—350 tpd

CHICAGO, ILL
Combination (recycled) board—175 tpd

CARTHAGE, IND.
Combination (recycled) board—100 tpd

WABASH, IND.
Combination (recycled) board—320 tpd

WHIPPANY, N.J.
(Idle mill of Whippany Paper Board)

CINCINNATI, OHIO
Combination (recycled) board—170 tpd

CIRCLEVILLE, OHIO
Pulp—200 tpd semichemical
Semichemical corrugating medium—300 tpd

PHILADELPHIA, PA.
Combination (recycled) board—475 tpd

CHATTANOOGA, TENN.
Combination (recycled) board—130 tpd

TACOMA, WASH.
Combination (recycled) board—65 tpd

Total production capacity:

PULP		
Kraft		2600 tpd
Semichemical		500 tpd
Total	3100 tpd	
PAPERBOARD		
Unbleached kraft		2210 tpd
Solid bleached		475 tpd
Semichemical corrugating medium		650 tpd
Combination (recycled)		2020 tpd
Total	5355 tpd	

Continental Forest Industries Inc.

21 Harbor Plaza
Stamford, Conn. 06904
Jess L. Belser, president

(CFI is a wholly-owned subsidiary of Continental Group Inc.)

Net sales:	
1981	$1,121,000,000
1980	1,098,400,000
Pre-tax operating earnings:	
1981	101,800,000
1980	76,100,000

All of Continental Forest's income is derived from pulp and paper. Production of paper and board in 1981 was 1,600,000 tons.

Pulp/paper operations of Continental Group of Canada Ltd. were divested in 1981, with two boxboard mills and three carton plants bought by Belkin Packaging and an additional converting plant sold to Dover Industries.

The three-year modernization program at Hodge, La., due for completion in 1982, increases kraft paper output by 21%. Increased production at Augusta, Ga., in 1981 enabled CFI to become the world's largest producer of bleached folding carton board.

Production facilities:

AUGUSTA, GA.
(Bleached System)
Pulp—800 tpd bleached kraft (some for market), 400 tpd thermomechanical
Bleached paperboard—1050 tpd

PORT WENTWORTH, GA.
(Brown System)
Pulp—700 tpd unbleached kraft
Unbleached kraft board—875 tpd

HODGE, LA.
(Brown System)
Pulp—1400 tpd kraft, 250 tpd semichemical
Packaging & kraft papers, corrugating medium—1550 tpd

HOPEWELL, VA.
(Brown System)
Pulp—970 tpd kraft
Unbleached kraft board—1100 tpd

Total production capacity:

PULP		
Kraft		3875 tpd
Thermomechanical		400 tpd
Semichemical		250 tpd
Total	4520 tpd	
PAPER & BOARD		
Packaging and other kraft papers		1550 tpd
Bleached paperboard		1050 tpd
Unbleached kraft board		1975 tpd
Total	4575 tpd	

Crown Zellerbach

One Bush St.
San Francisco, Calif. 94104
W.R. Creson, chairman/chief executive officer

(CZ has two wholly-owned subsidiaries, St. Francisville Paper Co. and Pulp Recycling Northeast; has a 50% share in Crown Simpson, and 85% ownership of Crown Zellerbach Canada Ltd.)

Net sales:	
1981	$3,148,300,000
1980	3,066,600,000
Net earnings:	
1981	75,300,000
1980	97,400,000

Sales of pulp and paper in 1981 were $1,296,000,000 and sales of containers and packaging were $607,000,000—together 60% of CZ's corporate sales, and accounting for 71% of operating earnings (59% for pulp/paper; 12% for packaging).

Production of paper and containerboard at CZ mills in 1981 was 2,378,000 tons; market pulp output was 301,000 tons. By grades, 1981 production was 414,000 tons of newsprint; 405,000 tons of other printing papers; 558,000 tons of business/converting paper; 330,000 tons of tissue and sanitary grades; 671,000 tons of containerboard.

Capital spending in 1981 at pulp/paper facilities was $216,000,000. Of this amount, $29,000,000 was for improvements to existing facilities and $187,000,000 for new capacity and cost reduction. CZ's eight-year 1977-84 $2,100,000,000 program was proceeding on schedule, emphasizing markets where CZ can achieve strong positions. Major program underway is the $400,000,000 expansion at Camas, Wash, due for 1984 completion. Completed in early 1982 is a $250,000,000 newsprint expansion at CZ Canada in Elk Falls, B.C.

CZ owns 2,027,000 acres of forestland in the U.S. and Canada, and an additional 1,355,000 acres are controlled.

Production facilities:

ANTIOCH, CALIF.
Paperboard—575 tpd
Tissue, toweling, napkin—(mill idle)

LOS ANGELES, CALIF.
Tissue and towel—80 tpd

FAIRHAVEN, CALIF.
(Crown Simpson Co., jointly owned)
Pulp—600 tpd kraft (CZ's share 300 tpd) (for market)

BOGALUSA, LA.
Pulp—1300 tpd unbleached kraft, 300 tpd semichemical
Containerboard—1475 tpd

ST. FRANCISVILLE, LA.
Pulp—570 tpd kraft, 260 tpd groundwood
Coated papers—550 tpd
Kraft paper/board—285 tpd

CARTHAGE, N.Y.
Pulp—40 tpd deinked
Tissue and towel—140 tpd

MOREAU, N.Y.
(Pulp Recycling Northeast)
(Mill idle)

SOUTH GLENS FALLS, N.Y.
Pulp—65 tpd deinked
Tissue and towel—135 tpd

BALTIMORE, OHIO
Paperboard—185 tpd

CLATSKANIE, ORE.
(Wauna Div.)
Pulp—836 tpd kraft (200 tpd for market), 325 tpd groundwood
Newsprint—370 tpd
Tissue—240 tpd
Industrial paper—200 tpd

LEBANON, ORE.
(Mill idle)

WEST LINN, ORE.
Pulp—125 tpd groundwood
Newsprint, groundwood printing, toweling, kraft papers—410 tpd

CAMAS, WASH.
Pulp—810 tpd kraft, 440 tpd magnefite
Tissue—290 tpd
Industrial papers—760 tpd
Fine papers—50 tpd

PORT ANGELES, WASH.
Pulp—365 tpd groundwood
Newsprint, groundwood printing—425 tpd

PORT TOWNSEND, WASH.
Pulp—450 tpd kraft
Paper & board—315 tpd kraft specialties, containerboard

CAMPBELL RIVER, B.C.
(Crown Zellerbach Canada)
Pulp—998 metric tpd kraft (535 tpd for market), 703 tpd thermomechanical, 272 tpd groundwood
Paper—1107 metric tpd newsprint, 109 tpd kraft specialties, 127 tpd linerboard

Total production capacity:

PULP (short tons)		
Kraft		5366 tpd
Groundwood		1375 tpd
Thermomechanical		775 tpd
Semichemical		300 tpd
Magnefite sulfite		440 tpd
Deinked		105 tpd
Total	8361 tpd	

PAPER (short tons)		
Newsprint/groundwood		2015 tpd
Tissue/toweling		885 tpd
Paperboard & kraft papers		1130 tpd
Containerboard		2375 tpd
Industrial papers		960 tpd
Coated paper		550 tpd
Fine paper		50 tpd
Total	7965 tpd	

Diamond International Corp.

733 Third Ave.
New York, N.Y. 10017
William J. Koslo, president/chief executive officer

(A merger proposal from Sir James Goldsmith's interests (Cavenham Holdings Inc., affiliate of Generale Occidentale SA) was under discussion in mid-1982; the acquisition would include Diamond's tissue and fine paper mills. In July 1982, Diamond reached an agreement to sell its packaging, container, paperboard and graphic arts divisions to a subsidiary of the Irish conglomerate Jefferson Smurfit. The Smurfit group gained ownership of Alton Packaging in 1981.)

Diamond's pulp, paper and packaging operations accounted for 58% of corporate sales in 1981. Pulp and paper sales were $221,000,000; operating income was $11,000,000. Packaging (which includes metal and plastic products) sales were $548,000,000, with operating income of $37,000,000.

Capital expenditures in 1981 for pulp and paper operations were $16,000,000.

Timberlands owned by Diamond, all in the U.S., comprise 1,700,000 acres.

Diamond National of Canada, a molded pulp facility in Brantford, Ont., was sold in 1981.

Production facilities:

RED BLUFF, CALIF.
(Fiber Products Div.)
Molded pulp products

OLD TOWN, MAINE
(Penobscot Div.)
Pulp—600 tpd bleached kraft (80 tpd for market)
Tissue and towel—170 tpd

HYDE PARK, MASS.
(Hyde Park Paper Div.)
Pulp—100 tpd deinked
Printing, writing & related paper—200 tpd

PALMER, MASS.
(Fiber Products Div.)
Molded pulp products

NATCHEZ, MISS.
(Fiber Products Div.)
Molded pulp products

GROVETON, N.H.
(Groveton Papers Co.)
Pulp—250 tpd semichemical
Semichemical board—300 tpd
Fine grades—300 tpd
Tissue and towel—50 tpd

GOUVERNEUR, N.Y.
(Groveton Papers Co.)
Tissue and towel—40 tpd

PLATTSBURGH, N.Y.
(Fiber Products Div.)
Molded pulp products

LOCKLAND, OHIO
(Paperboard Div.)
Combination (recycled board)—280 tpd

MIDDLETOWN, OHIO
(Paperboard Div.)
Combination (recycled) board—275 tpd

Total production capacity:

PULP		
Kraft		600 tpd
Semichemical		250 tpd
Deinked		100 tpd
Total	950 tpd	

PAPER & BOARD		
Printing, writing & fine paper		500 tpd
Tissue and towel		260 tpd
Combination (recycled) board		555 tpd
Semichemical board		300 tpd
Total	1615 tpd	

Domtar Inc.

395 de Maisonneuve Blvd. W.
Montreal, Que. H3A 1L6
Alex D. Hamilton, chairman/chief executive officer

Net sales (C$):	
1981	$1,764,700,000
1980	1,653,200,000
Net earnings (C$):	
1981	63,600,000
1980	94,600,000

(More than 40% of Domtar is jointly owned by Caisse de dépôt et placement du Québec and Soc. Générale de Financement du Québec.)

Sales of Domtar's Pulp & Paper Products group in 1981 of C$856,000,000 were marginally higher than the $852,000,000 in 1980. Pulp and newsprint achieved higher sales volumes which were partially offset by lower volumes in other papers and in lumber. Operating profit in 1981 of $62,600,000 was down from 1980's $96,100,000.

Trade sales of fine papers and envelopes in 1981 were $424,300,000, 24% of Domtar's total; production of fine and specialty papers was 236,356 metric tons. Sales of newsprint/groundwood specialty papers were $240,000,000, 13.6% of total; output was 383,137 tons. Pulp sales, at $112,300,000, were 6.4% of corporate total; production of market pulp was 211,470 tons. Sales of kraft paper/boxboard were $54,800,000, 3.1% of total; output was 122,797 tons.

Capital spending in 1981 totaled $164,300,000, of which $50,800,000 was for pulp/paper facilities and $49,300,000 for packaging operations. Major projects underway include new recovery boiler at Red Rock, Ont.; conversion to 100% TMP pulp at Donnacona, Que.; a new woodwaste boiler at Dolbeau, Que.

Domtar's timberlands comprise 875,000 acres owned and 10,000,000 controlled.

Production facilities:

Domtar Construction Materials:

THOROLD, ONT.
(Roofing & Fiberboard Products)
Roofing felt—64 metric tpd

DONNACONA, QUE.
(Roofing & Fiberboard Products)
Insulation board ½ in.)—400,000 ft^2/day (est. 127 metric tpd)

SAN LEANDRO, CALIF.
(Domtar Gypsum America)
Chipboard, gypsum linerboard—150 short tpd

Domtar Pulp & Paper:

CORNWALL, ONT.
(Fine Papers Div.)
Pulp—408 metric tpd kraft
Fine papers—658 metric tpd

ST. CATHARINES, ONT.
(Fine Papers Div.)
Fine papers—136 metric tpd

DON VALLEY, ONT.
(Fine Papers Div.)
Fine papers—32 metric tpd

BEAUHARNOIS, QUE.
(Fine Papers Div.)
Fine papers—50 metric tpd

WINDSOR, QUE.
(Fine Papers Div.)
Pulp—390 metric tpd kraft (191 tpd for market)
Fine papers—191 metric tpd
Kraft papers—68 metric tpd

DOLBEAU, QUE.
(Newsprint Div.)
Pulp—163 metric tpd sulfite, 318 tpd groundwood
Newsprint—435 metric tpd

DONNACONA, QUE.
(Newsprint Div.)
Pulp—109 metric tpd sulfite, 168 tpd groundwood, 240 tpd thermomechanical
Newsprint—122 metric tpd
Groundwood printing—363 metric tpd

LEBEL-SUR-QUEVILLON, QUE.
(Pulp Div.)
Pulp—680 metric tpd kraft (for market)

MISSISSAUGA, ONT.
(Packaging Div.)
Linerboard—227 metric tpd

RED ROCK, ONT.
(Packaging Div.)
Pulp—667 metric tpd kraft, 163 tpd groundwood
Linerboard—608 metric tpd
Newsprint—191 metric tpd

TRENTON, ONT.
(Packaging Div.)
Pulp—136 metric tpd semichemical
Corrugating medium—172 metric tpd

EAST ANGUS, QUE.
(Kraft Paper & Boxboard Div.)
Pulp—218 metric tpd kraft
Kraft papers—218 metric tpd
Boxboard—91 metric tpd

Total production capacity:

PULP	
Kraft	2363 metric tpd
Sulfite	272 metric tpd
Groundwood	649 metric tpd
Semichemical	136 metric tpd
TMP	240 metric tpd
Total	3660 metric tpd
PAPER & BOARD	
Newsprint	748 metric tpd
Fine papers	1067 metric tpd
Kraft papers	286 metric tpd
Groundwood spec.	363 metric tpd
Linerboard	835 metric tpd
Boxboard	91 metric tpd
Corrugating medium	172 metric tpd
Gypsum paper	136 metric tpd
Total	3698 metric tpd
BUILDING BOARD	
Roofing felt	64 metric tpd
Insulation board	127 metric tpd
Total	191 metric tpd

Donohue Inc.

500 Grande-Allée East
Quebec City, Que. G1R 2J7
Edward P. Walsh, president/chief executive officer

(Owns 55% of Donohue Charlevoix Inc.; 65% of Donohue Malbaie Inc.; 55% of Donohue St-Felicien Inc. and 51% of Donohue Normick Inc. Soc. Générale de Financement du Québec, a Québec government agency, owns 54.9% of Donohue; Cellulose du Pin of France has 34.3%)

Net sales (C$):	
1981	$289,882,000
1980	272,455,000
Net earnings (C$):	
1981	24,857,000
1980	26,028,000

Sales of pulp and paper comprise 85% of Donohue's total, with the other 15% from lumber. Production in 1981 totaled 239,500 metric tons of newsprint at Clermont and 271,300 tons of pulp at St-Felicien (13% above designed capacity).

The joint-venture newsprint mill of Donohue Normick started up the first quarter of 1982. Estimated total cost of the mill is C$190,000,000, of which $105,056,000 was disbursed in 1981 and an additional $48,052,000 was budgeted for 1982.

Capital spending for improvements at Clermont and St-Felicien were $19,696,000 in 1981. In 1982, about $30,342,000 will be spent.

Production facilities:

AMOS, QUE.
(Donohue Normick Inc.)
Pulp—480 metric tpd thermomechanical
Newsprint—450 metric tpd

CLERMONT, QUE.
Pulp—136 metric tpd sulfite, 545 tpd groundwood
Newsprint—640 metric tpd (227 tpd for Donohue; 309 tpd Donohue Charlevoix Inc.; 104 tpd Donohue Malbaie Inc.)

ST-FELICIEN, QUE.
(Donohue St-Felicien)
Pulp—760 metric tpd bleached kraft for market (Donohue's share—465 tpd)

Total production capacity:

PULP	
Sulfite	136 metric tpd
Groundwood	545 metric tpd
TMP	480 metric tpd
Kraft	456 metric tpd
Total	1617 metric tpd
PAPER	
Newsprint	1090 metric tpd

Eddy Paper Co. Ltd.

1335 Carling Ave.
Ottawa, Ont. K1Y 4L5
J.C. Scarth, president/chief executive officer

(Wholly-owned subsidiary of George Weston Ltd., Eddy Paper Products in turn owns E.B. Eddy Forest Products Ltd. and Eastern Fine Paper Inc.)

Net sales (C$):	
1981	$421,618,000
1980	385,218,000

Earnings data are not available. About 91% of 1981 sales were derived from pulp, paper and converted products.

Production of paper in 1981 was 278,500 metric tons; pulp output was 218,000 tons (close to 100,000 tons for market).

Eddy's capital spending in 1981 totaled C$84,100,000, of which $74,600,000 went for pulp/paper facilities. Budget for 1982 was $120,200,000, with $109,500,000 for pulp/paper operations.

Production facilities:

ESPANOLA, ONT.
(E.B. Eddy Forest Products)
Pulp—650 metric tpd kraft (272 tpd for market)
Specialty papers—109 metric tpd

OTTAWA, ONT.
(E.B. Eddy Forest Products)
Fine & specialty papers—168 metric tpd

HULL, QUE.
(E.B. Eddy Forest Products)
Tissue—222 metric tpd
Fine & specialty papers—240 metric tpd

BREWER, MAINE
(Eastern Fine Paper Inc.)
Printing, writing & related papers—163 metric tpd (180 short tpd)

Total production capacity:

PULP	
Kraft	650 metric tpd
PAPER	
Fine/specialty papers	680 metric tpd
Tissue	222 metric tpd
Total	902 metric tpd

Eurocan Pulp & Paper Ltd.

1176 W. Georgia St., No. 1600
Vancouver, B.C. V6E 4A2
Lars H. Wrede, president

(Eurocan is owned 60% by Enso-Gutzeit Oy of Finland and 40% by West Fraser Timber Co. of B.C.)

Net sales (C$):	
1981	$147,000,000
1980	164,000,000

Other financial data not available. Pulp and paper/board products account for 70% of total sales.

Production of paper and paperboard in 1981 was 250,342 metric tons.

The Kitimat operation is in the final stages of a C$38,000,000 rebuild of the board machine and pulp and boiler modifications expected to increase daily production to 1000 metric tpd.

Production facilities:

KITIMAT, B.C.
Pulp—900 metric tpd kraft (some for market)
Linerboard and kraft paper—900 metric tpd

Total production capacity:

PULP	900 metric tpd
PAPER & BOARD	900 metric tpd

Federal Paper Board Co. Inc.

75 Chestnut Ridge Rd.
Montvale, N.J. 07645
John R. Kennedy Jr., president/chief executive officer

Net sales:	
1981	$520,347,000
1980	476,125,000
Net earnings:	
1981	31,044,000
1980	29,133,000

Pulp, paperboard and converted products comprised 97% of 1981 sales. More than half was for products of the Riegelwood facility sold to unaffiliated customers: $171,802,000 in bleached paperboard, $109,652,000 for pulp. Export sales in 1981 were $87,763,000, of which $50,310,000 were to European customers. Bleached paperboard production was 323,000 tons.

The five-year pulp expansion at Riegelwood was basically completed in spring 1982. Production at the mill in 1981 was 608,000 tons, an average of 1587 tpd, and is expected to reach design capacity of 2000 tpd (half bleached paperboard, half market pulp) by end-1982.

Total production at Federal's four mills in 1981 was 580,000 tons of paperboard (bleached and recycled) and 285,000 tons of market pulp.

Capital expenditures in 1981 were $114,049,000 ($67,400,000 for Riegelwood expansion). Spending in 1982 will be $68,059,000 ($34,000,000 for Riegelwood).

Federal controls 117,000 acres of timberland in U.S. and owns 263,000 acres, for a total of 380,000 acres.

Production facilities:

CITY OF COMMERCE, CALIF.
Combination paperboard—147 tpd

VERSAILLES, CONN.
(Sprague Div.)
Combination paperboard—465 tpd

RIEGELWOOD, N.C.
Pulp—1850 tpd bleached kraft (950 tpd for market)
Bleached paperboard—900 tpd

RICHMOND, VA.
Combination paperboard—220 tpd

Total production capacity:

PULP	1850 tpd
PAPERBOARD	1732 tpd

Fort Howard Paper Co.

1919 S. Broadway
Green Bay, Wis. 54304
Paul J. Schierl, president/chief executive officer

Net sales:	
1981	$471,261,000
1980	397,403,000
Net earnings:	
1981	83,050,000
1980	68,700,000

Paper and paper products account for 100% of Fort Howard's sales. In 1981, paper towels represented 36% of sales; napkins, 32%; tissues, 28%; and other, 4%.

Capital expenditures in 1981 were $46,100,000 (approximately $15,000,000 at Muskogee, and $31,000,000 at Green Bay). Muskogee's third tissue machine started up in May 1981. Capital spending in 1982 is set at $40,000,000 ($15,000,000 at Muskogee, $25,000,000 at Green Bay).

Production facilities:

(Fort Howard does not release capacity data; figures below are P&P estimates)

MUSKOGEE, OKLA.
Pulp—775 tpd deinked
Tissue, toweling, napkin grades—800 tpd

GREEN BAY, WIS.
Pulp—775 tpd deinked
Tissue, toweling, napkin grades—800 tpd

Total production capacity:

PULP	
Deinked	1550 tpd
PAPER	
Tissue, towel, napkin	1600 tpd

Fraser Inc.

27 Rice St.
Edmundston, N.B. E3V 1S9
John P. Fisher, president

(Fraser is owned 64% by Noranda Mines Ltd., and owns Fraser Paper Ltd.)

Net sales (C$):	
1981	$422,172,000
1980	362,184,000
Net earnings (C$):	
1981	16,183,000
1980	29,346,000

Pulp and paper/board account for 96% of Fraser's 1981 sales. Production of 441,037 metric tons of paper and board included output, in the second half of 1981, from the fine paper mill at Thorold, Ont., acquired from Abitibi in mid-1981.

Sales of Fraser products in 1981 comprised 177,972 metric tons of fine papers; 115,421 tons of uncoated groundwood papers; 121,861 tons of coated groundwood grades; 25,783 tons of boxboard; and 41,982 tons of market pulp.

1981 saw the start of the long-awaited conversion/modernization at Atholville, N.B., and also commencement of the energy program to supply power to Madawaska from Edmundston via a 7000-ft pipeline. Capital expenditures in 1981 were C$59,000,000, and $116,800,000 was expected to be spent in 1982.

Fraser owns 766,000 acres of timberland in Canada, and controls 1,107,000 acres under Crown license.

Production facilities:

MADAWASKA, MAINE
(Fraser Paper Ltd.)
Fine papers—440 short tpd
Groundwood printing/publication papers—810 short tpd (460 tpd coated, 350 tpd uncoated)

ATHOLVILLE, N.B.
Pulp—272 metric tpd sulfite (195 tpd for market)

EDMUNDSTON, N.B.
(Fraser Inc.)
Pulp—308 metric tpd groundwood, 553 tpd sulfite
Paperboard—72 metric tpd

THOROLD, ONT.
(Fraser Paper Ltd.)
- Pulp—100 metric tpd deinked
  Fine papers—245 metric tpd

Total production capacity:

PULP	
Groundwood	308 metric tpd
Sulfite	825 metric tpd
Total	1133 metric tpd
PAPER & BOARD	
Fine papers	644 metric tpd
Printing papers	735 metric tpd
Paperboard	82 metric tpd
Total	1461 metric tpd

GAF Corp.

140 W. 51st St.
New York, N.Y. 10020
John A. Brennan, senior vice president, building materials group

Financial data for roofing products not available.

In view of the poor building market, GAF sold or closed several roofing felt mills in 1980 and 1981.

Production facilities:

MOBILE, ALA.
Pulp—50 tpd defibrated
Roofing felt—120 tpd

SAVANNAH, GA.
Pulp—50 tpd refiner mechanical, 75 tpd defibrated
Roofing felt—145 tpd

JOLIET, ILL.
Pulp—120 tpd defibrated
Roofing felt—280 tpd

KANSAS, MO.
(Mill closed 1980)

GLOUCESTER CITY, N.J.
Pulp—165 tpd defibrated
Roofing & flooring felt—400 tpd

DALLAS, TEXAS
Pulp—40 tpd defibrated
Roofing felt—70 tpd

Total production capacity:

PULP	
Defibrated	450 tpd
Refiner mechanical	50 tpd
Total	500 tpd
PAPER & BOARD	
Roofing & flooring felt	1015 tpd

Garden State Paper Co. Inc.

111 N. Fourth St.
Richmond, Va. 23219
Basil Snider Jr., president/chief executive officer

(A wholly-owned subsidiary of Media General Inc. which also has a 33⅓% interest in Southeast Paper Mfg. Co. and 20% interest in FSC Paper Co. These mills license and utilize the Garden State process for making newsprint; as does Productora Nacional de Papel Destintado in Mexico, in which Media General has a 49% interest)

Net sales:	
1981	$144,842,000
1980	143,644,000
Operating profit:	
1981	26,677,000
1980	25,410,000

Production of newsprint from recycled newspapers at Garden State's two mills was 295,300 tons in 1981. Production from these two mills plus the joint-venture plants in Illinois and Georgia accounts for 14% of U.S.-made newsprint.

A major rebuild at the California plant, to increase capacity 23%, required 40 days of downtime in 1981 and a reduction in tonnage produced.

Production facilities:

POMONA, CALIF.
Pulp—365 tpd deinked
Newsprint—365 tpd

DUBLIN, GA.
(Southeast Paper Mfg. Co., joint venture)
Pulp—450 tpd deinked (150 tpd Garden State's share)
Newsprint—450 tpd newsprint (150 tpd Garden State's share).

GARFIELD, N.J.
Pulp—600 tpd deinked
Newsprint—600 tpd

ALSIP, ILL.
(FSC Paper Corp., joint venture)
Pulp—300 tpd deinked (60 tpd Garden State's share)
Newsprint—300 tpd (60 tpd Garden State's share)

Total production capacity:

PULP	1175 tpd
PAPER	1175 tpd

Georgia-Pacific Corp.

133 Peachtree St. N.E.
Atlanta, Ga. 30303
Robert E. Floweree, chairman/chief executive officer

Net sales:	
1981	$5,414,000,000
1980	5,016,000,000
Net earnings:	
1981	160,000,000
1980	243,000,000

In 1981, G-P acquired two roofing plants and nine container plants in the U.S. and Inveresk Paper Co. Ltd. in U.K.; also Holly Hill Lumber Co. in U.S.

Sales of pulp and paper, at $1,580,000,000, accounted for 29% of G-P's 1981 total. An additional $43,000,000 in inter-segment sales brought pulp/paper sales to $1,623,000,000. Operating profit of pulp/paper group was $166,000,000, also 29% of G-P total.

By product, G-P sales in 1981 comprised $248,000,000 in market pulp, $288,000,000 for tissue, $375,000,000 for printing and specialty papers, $569,000,000 for containers and packaging.

Capital spending in 1982 was expected to be about $225,000,000, a substantial drop from $675,000,000 in 1981 (of which $265,000,000 was spent at pulp/paper mills—$70,000,000 for new plant and equipment, $195,000,000 for replacement and modernization).

G-P owns 4,245,000 acres of timberland in U.S. and 370,000 acres in Canada, and 515,000 acres in U.S. are controlled, for a total of 5,130,000 acres.

Production facilities:

CROSSET, ARK.
Pulp—1410 tpd kraft (200 tpd for market)
Kraft paper—525 tpd
Tissue and towel—410 tpd
Solid bleached board—455 tpd

PALATKA, FLA.
Pulp—1200 tpd kraft (150 tpd for market)
Packaging, industrial converting paper—640 tpd
Tissue—390 tpd

TAYLORVILLE, ILL.
Printing/writing paper—94 tpd

GARY, IND.
Pulp—85 tpd deinked
Tissue and towel—77 tpd

PORT HUDSON, LA.
Pulp—1285 tpd bleached kraft (for market)

WOODLAND, MAINE
Pulp—800 tpd kraft (550 tpd for market)
Printing paper—255 tpd

KALAMAZOO, MICH.
Pulp—240 tpd deinked
Printing paper—470 tpd

DELAIR, N.J.
Gypsum board liner—205 tpd

LYONS FALLS, N.Y.
Pulp—120 tpd semichemical, 30 tpd deinked
Printing paper—213 tpd

PLATTSBURGH, N.Y.
Pulp—102 tpd semichemical
Tissue and towel—285 tpd

CONWAY, N.C.
Pulp—200 tpd defibrated
Hardboard—590,000 ft²/day (est. 205 tpd)

PRYOR, OKLA.
Pulp—50 tpd defibrated
Gypsum board liner—175 tpd

TOLEDO, ORE.
Pulp—1400 tpd kraft, 335 tpd semichemical
Unbleached kraft paper—300 tpd
Unbleached kraft board—775 tpd

READING, PA.
Printing paper—55 tpd

JARRATT, VA.
Pulp—250 tpd defibrated
Hardboard—660,000 ft²/day (210 tpd)

GILMAN, VT.
Pulp—30 tpd deinked
Printing paper—195 tpd

BELLINGHAM, WASH.
Pulp—585 tpd sulfite (350 tpd for market), 114 tpd semichemical
Tissue and towel—255 tpd
Combination (recycled) board—50 tpd

TOMAHAWK, WIS.
Tissue and towel—20 tpd

THOROLD, ONT.
Gypsum board liner/paperboard—290 metric tpd

Total production capacity:

PULP		
Kraft		6095 tpd
Semichemical		671 tpd
Sulfite		585 tpd
Defibrated		500 tpd
Deinked		385 tpd
Total	8236 tpd	

PAPER		
Printing/writing		1282 tpd
Tissue		1437 tpd
Kraft papers		905 tpd
Packaging/industrial		640 tpd
Total	4264 tpd	

PAPERBOARD		
Unbleached kraft board		775 tpd
Bleached board		455 tpd
Recycled board		50 tpd
Gypsum board liner		700 tpd
Total	1980 tpd	

TOTAL PAPER & BOARD	6244 tpd

BUILDING BOARD	
Hardboard	415 tpd

Gilman Paper Co.

111 W. 50th St.
New York, N.Y. 10020
Howard Gilman, chairman/president/chief executive officer

Financial and production data not available.

Production facilities:

ST. MARYS, GA.
(St. Marys Kraft Div.)
Pulp—1200 tpd kraft (750 tpd bleached, 450 tpd unbleached)
Paper & board—1200 tpd

Total production capacity:

PULP	1200 tpd
PAPER & BOARD	1200 tpd

P.H. Glatfelter Co.

Main St.
Spring Grove, Pa. 17362
T.C. Norris, president/chief executive officer

(Owns Glatfelter Pulp Wood Co.)

Net sales:	
1981	$265,540,000
1980	262,808,000
Net earnings:	
1981	16,502,000
1980	21,437,000

Glatfelter's 1981 operations were adversely affected by a first-ever strike at Spring Grove, Pa., and difficulties and delays in rebuild of the third paper machine at West Carrollton, Ohio.

Company timberlands, managed by Glatfelter Pulp Wood Co., comprise 101,000 acres.

Production facilities:

WEST CARROLLTON, OHIO
(Bergstrom Paper Div.)
Pulp—275 tpd bleached deinked
Fine papers—350 tpd

SPRING GROVE, PA.
Pulp—550 tpd bleached kraft
Printing/writing papers—575 tpd

NEENAH, WIS.
(Bergstrom Paper Div.)
Pulp—250 tpd bleached deinked
Fine papers—325 tpd

Total production capacity:

PULP		
Bleached deinked		475 tpd
Kraft		550 tpd
Total	1025 tpd	

PAPER		
Fine papers		675 tpd
Printing/writing		575 tpd
Total	1250 tpd	

Great Lakes Forest Products Ltd.

Box 430
Thunder Bay, Ont. P7C 4W3
Charles J. Carter, chairman/president

(Canadian Pacific Enterprises owns approximately 54% of Great Lakes)

Net sales (C$):	
1981	$568,594,000
1980	539,279,000
Net earnings (C$):	
1981	77,774,000
1980	81,352,000

Sales of pulp and paper by Great Lakes in 1981 were $529,671,000, 93% of total; the balance was in building products. Shipments of newsprint in 1981 totaled 386,000 metric tons, fine paper was 64,000 tons, and kraft pulp 504,000 tons.

Capital expenditures in 1981 were $189,000,000, of which $148,000,000 was spent on the Dryden mill modernization programs. These comprise a kraft pulp expansion in 1982 and new fine paper machine in 1983. Expenditures in 1982 were expected to be $145,800,000 for mill facilities and $10,126,000 for woodlands.

Production facilities:

DRYDEN, ONT.
Pulp—490 metric tpd, bleached and unbleached
Fine and kraft papers—215 metric tpd

THUNDER BAY, ONT.
Pulp—1280 metric tpd bleached kraft (for market); 340 tpd high-yield sulfite, 910 tpd groundwood
Newsprint—1130 tpd metric

Total production capacity:

PULP		
Kraft		1770 metric tpd
Sulfite		340 metric tpd
Groundwood		910 metric tpd
Total	3020 metric tpd	

PAPER		
Fine and kraft papers		215 metric tpd
Newsprint		1130 metric tpd
Total	1345 metric tpd	

Great Northern Nekoosa Corp.

75 Prospect St., P.O. Box 0309
Stamford, Conn. 06904
Robert Hellendale, president/chief executive officer

Net sales:	
1981	$1,493,000,000
1980	1,373,300,000
Net earnings:	
1981	95,000,000
1980	98,700,000

Including converting and distribution operations, pulp and paper/board comprise 95% of GNN sales. In 1981, sales of business papers totaled $466,500,000; groundwood printing papers $270,800,000; newsprint $134,800,000; containerboard $225,700,000; market pulp $28,500,000.

1981 shipments of business papers reached 631,000 tons; groundwood printing papers were 518,000 tons; newsprint 317,000 tons; containerboard 847,000 tons; market pulp 75,000 tons. Total shipments were 2,388,000 tons. Total 1981 production was 2,316,000 tons of paper/board and 75,000 tons of pulp (97% of reported capacity).

Capital expenditures in 1981 came to $97,900,000; budget for 1982 spending was $283,000,000. The bulk of this is for the new Leaf River pulp mill being built for mid-1984 operation.

GNN's timberlands comprise 2,775,000 acres owned and 86,000 acres controlled, all in U.S.

Production facilities:

ASHDOWN, ARK.
(Nekoosa Papers)
Pulp—1285 tpd bleached kraft (215 tpd for market)
Business communication paper—1000 tpd

CEDAR SPRINGS, GA.
(Great Southern Paper)
Pulp—1950 tpd kraft, 400 tpd semichemical
Linerboard—1950 tpd
Corrugating medium—500 tpd

EAST MILLINOCKET, MAINE
(Great Northern Paper)
Pulp—725 tpd groundwood
Newsprint, groundwood printing papers—1015 tpd

MILLINOCKET, MAINE
(Great Northern Paper)
Pulp—840 tpd groundwood, 710 tpd sulfite
Groundwood specialty paper—1400 tpd
Wrapper—25 tpd

NEW AUGUSTA, MISS.
(Leaf River Forest Products)
After startup in 1984, will produce 1000 tpd bleached kraft pulp (for market)

NEKOOSA, WIS.
(Nekoosa Papers)
Pulp—350 tpd kraft
Business communication papers—490 tpd

PORT EDWARDS, WIS.
(Nekoosa Papers)
Pulp—235 tpd sulfite
Business communications papers—410 tpd

Total production capacity:

PULP		
Kraft		3585 tpd
Semichemical		400 tpd
Groundwood		1565 tpd
Sulfite		945 tpd
Total	6495 tpd	

PAPER & BOARD		
Newsprint, groundwood papers		2415 tpd
Business communications papers		1980 tpd
Containerboard		2450 tpd
Wrapper		25 tpd
Total	6790 tpd	

Green Bay Packaging Inc.

Box 1107
Green Bay, Wis. 54305
James F. Kress, president/chief executive officer

(Arkansas Kraft Corp. is a subsidiary)

Financial data not available.

Production facilities:

MORRILTON, ARK.
(Arkansas Kraft Corp.)
Pulp—800 tpd kraft
Unbleached paperboard—1075 tpd

GREEN BAY, WIS.
(Paper Mill Div.)
Pulp—220 tpd semichemical
Paperboard—300 tpd

Total production capacity:

PULP		
Semichemical		220 tpd
Kraft		800 tpd
Total	1020 tpd	
PAPERBOARD		1375 tpd

Gulf States Paper Corp.

Box 3199
Tuscaloosa, Ala. 35401
J.W. Warner, chairman/president

Production in 1981 was 189,000 tons of paperboard and 17,000 tons of pulp.

Production facilities:

DEMOPOLIS, ALA.
Pulp—560 tpd unbleached kraft (55 tpd for market); 35 tpd deinked
Paperboard—575 tpd

Total production capacity:

PULP		
Kraft		560 tpd
Deinked		35 tpd
Total	595 tpd	
PAPERBOARD		575 tpd

Hammermill Paper Co.

East Lake Rd., Box 1440
Erie, Pa. 16533
Albert F. Duval, president/chief executive officer

(Owns one-third of Grays Harbor Paper Co.)

Net sales:	
1981	$1,399,694,000
1980	1,229,323,000
Net earnings:	
1981	46,638,000
1980	40,830,000

Hammermill achieved record earnings in 1981 despite the problem-plagued economy. Top performer was the industrial and packaging papers segment, with a $34,800,000 operating profit (more than double that of 1980). Operating profit for fine and printing papers dropped about 30% to $37,300,000.

Sales of fine and printing papers in 1981 were $415,100,000; industrial and packaging papers were $240,100,000; converted products $118,800,000; and wholesale distribution sales $643,800,000.

Capital expenditures in 1981 were $141,000,000; and for the five years ending with 1985, Hammermill was projecting a total spending program of more than $500,000,000. A major project, begun in 1981, is a second expansion at the pulp mill at Selma, Ala., to add 450 tpd by 1984. Paper capacity expansions include a 20% addition to Strathmore operations and an expansion at Grays Harbor.

Production facilities:

SELMA, ALA.
(Riverdale Plant, HPG)
Pulp—650 tpd kraft (for market)

WESTFIELD, MASS.
(Strathmore Paper Co.)
Printing/writing paper—91 tpd

OSWEGO, N.Y.
(Oswego Plant, HPG)
Printing/writing paper—200 tpd

GREEN ISLAND, N.Y.
(Manning Paper Co.)
Packaging industrial converting paper—42 tpd

HAMILTON, OHIO
(Beckett Paper Co.)
Printing/writing paper—160 tpd

ERIE, PA.
(Erie Plant, HPG)
Pulp—640 tpd Neutracel II alkaline (for market)
Printing/writing paper—421 tpd

LOCK HAVEN, PA.
(Lock Haven Plant, HPG)
Printing/writing paper—529 tpd

HOQUIAM, WASH.
(Grays Harbor Paper Co., jointly owned)
Printing, writing & related paper—100 tpd (Hammermill's ⅓ share)

KAUKAUNA, WIS.
(Thilmany Pulp & Paper)
Pulp—400 tpd kraft
Packaging industrial converting paper—550 tpd

Total production capacity:

PULP		
Kraft		1050 tpd
Alkaline		640 tpd
Total	1690 tpd	
PAPER		
Printing/writing paper		1501 tpd
Packaging, industrial converting		592 tpd
Total	2093 tpd	

ITT Rayonier Inc.

1177 Summer St.
Stamford, Conn. 06904
Ronald M. Gross, president/chief executive officer

(ITT Rayonier is a subsidiary of International Telephone & Telegraph Corp. Rayonier operations include Rayonier New Brunswick, a division of ITT Industries of Canada Ltd. ITT Rayonier jointly owns (67%) Grays Harbor Paper Co. with Hammermill, which operates the mill and markets its products)

Net sales:	
1981	$644,000,000
1980	752,000,000

Sales of pulp in 1981, down 5% from 1980, were $425,000,000 (66% of Rayonier's sales). Production at the four mills was 828,000 short tons (751,000 metric tons). By mill, the 1981 output was: Jesup 456,000 tons; Fernandina 154,000 tons; Port Angeles 141,000 tons; Grays Harbor 69,000 tons. Production in 1981 was down 10% from 1980 level due to market curtailments.

Capital expenditures in 1981 were $149,000,000. With completion of the $111,000,000 2450-tpd recovery boiler at Jesup in mid-1982, an opportunity for expansion at that location is provided.

Rayonier's timberlands in the U.S. comprise 1,330,000 acres, of which 1,170,000 acres are owned and 160,000 acres controlled.

Production facilities:

FERNANDINA BEACH, FLA.
(Fernandina Div.)
Pulp—460 tpd sulfite (for market)

JESUP, GA.
(Jesup Div.)
Pulp—1410 tpd kraft dissolving and bleached papermaking (for market)

HOQUIAM, WASH.
(Grays Harbor Div.)
Pulp—500 tpd sulfite (for market)

HOQUIAM, WASH.
(Grays Harbor Paper Co.)
Printing/writing paper—300 tpd
(Rayonier's share 200 tpd)

PORT ANGELES, WASH.
(Port Angeles Div.)
Pulp—500 tpd sulfite (for market)

PORT CARTIER, QUE.
(Rayonier Quebec Ltd.)
(Mill closed)

Total production capacity:

PULP		
Sulfite		1460 tpd
Kraft		1410 tpd
Total	2870 tpd	
PAPER		200 tpd

International Paper Co.

77 W. 45th St.
New York, N.Y. 10036
Dr. Edwin A. Gee, chairman/chief executive officer

(Sold Canadian International Paper Co. to Canadian Pacific Enterprise)

Net sales:	
1981	$4,984,000,000
1980	5,043,000,000

Net earnings:	
1981	525,000,000
1980	314,000,000

Pulp, paper/board and converted products account for 85% of IP's sales volume. Sales of pulp and paper in 1981 were $1,968,400,000; of packaging and packaging materials $2,251,600,000.

Despite divestiture of its Canadian operations, IP continues to be the world's largest producer of pulp, paper and paper packaging. Current annual capacity of IP's U.S. facilities is 5,580,000 tons of paper/board and 600,000 tons of market pulp.

Production in 1981 by products: printing/writing and bristols, 1,390,000 tons; newsprint 1,130,000 tons (includes divested Canadian mills); containerboard 1,780,000 tons; bleached board 880,000 tons, industrial papers 500,000 tons; chemical cellulose and specialty pulps 560,000 tons; paper pulp 370,000 tons (includes 80,000 tons shipped to other IP mills for own use).

Capital spending for IP's pulp/paper facilities in 1981 totaled $445,000,000, of which $135,000,000 was for modernization and $310,000,000 for expansion programs. Major investment was for completion of the 730,000-tpy containerboard mill at Mansfield, La.

Capital spending in the 1982-85 period is planned to total about $3,400,000,000 at a rate of around $850,000,000 a year (including payments for timber leases). Reconstruction of the Georgetown, S.C., mill to all-bleached production is the biggest single project; conversion of boilers to reduce dependence on oil and gas is another major target for spending.

Production facilities:

MOBILE, ALA.
Pulp—1035 tpd kraft, 180 tpd groundwood, 55 tpd thermomechanical
Newsprint—340 tpd
Printing/writing paper—215 tpd
Packaging/industrial converting paper—800 tpd

CAMDEN, ARK.
Pulp—725 tpd kraft
Packaging/industrial converting paper—715 tpd

PINE BLUFF, ARK.
Pulp—1125 tpd bleached kraft, 345 tpd groundwood
Newsprint—515 tpd
Solid bleached board—1035 tpd

BASTROP, LA.
(Bastrop Mill)
Pulp—495 tpd semichemical
Semichemical board—606 tpd

BASTROP, LA.
(Louisiana Mill)
Pulp—1200 tpd bleached kraft
Printing/writing paper—500 tpd
Solid bleached board—550 tpd

MANSFIELD, LA.
Pulp—1450 tpd unbleached kraft, 550 tpd semichemical
Linerboard—1300 tpd
Corrugating medium—750 tpd

PINEVILLE, LA.
Pulp—975 tpd kraft
Unbleached kraft board—985 tpd

JAY, MAINE
(Androscoggin Mill)
Pulp—1200 tpd kraft, 130 tpd groundwood
Printing/writing paper—1305 tpd

MOSS POINT, MISS.
Pulp—750 tpd kraft
Printing/writing paper—150 tpd
Packaging/industrial converting paper—100 tpd
Solid bleached board—535 tpd

NATCHEZ, MISS.
Pulp—1135 tpd bleached kraft (for market)

VICKSBURG, MISS.
Pulp—1180 tpd kraft
Unbleached kraft board—1350 tpd

CORINTH, N.Y.
(Hudson River Mill)
Pulp—150 tpd groundwood
Printing/writing paper—480 tpd

TICONDEROGA, N.Y.
Pulp—530 tpd kraft
Printing/writing paper—690 tpd

GARDINER, ORE.
Pulp—800 tpd kraft
Unbleached kraft board—850 tpd

GEORGETOWN, S.C.
Pulp—1600 tpd kraft, 150 tpd semichemical
Linerboard—1350 tpd
Corrugating medium—200 tpd
Solid bleached board—315 tpd

TEXARKANA, TEXAS
Pulp—1300 tpd kraft (est. 500 tpd for market)
Solid bleached board—650 tpd ('swing' to market pulp or additional bleached board)

Total production capacity:

PULP	
Kraft	15,005 tpd
Groundwood	805 tpd
Thermomechanical	55 tpd
Semichemical	1195 tpd
Total	17,060 tpd
PAPER	
Newsprint	885 tpd
Printing/writing	3340 tpd
Packaging/industrial converting	1615 tpd
Total	5810 tpd
PAPERBOARD	
Solid bleached board	3085 tpd
Unbleached	5835 tpd
Semichemical	1556 tpd
Total	10,476 tpd
TOTAL PAPER & BOARD	16,286

Interstate Resources Inc.

300 E. 42nd St.
New York, N.Y. 10017
Howard D. Epstein, chairman

(In mid-1982 Interstate Paper Corp. and Interstate Intercorr Corp. were merged into Interstate Resources Inc., a new Cincinnati, Ohio-based company jointly owned by William F. Belote (whose Agri-Timber Inc. acquired Interstate in 1981) and George N. Frem, chairman of Indevco, of Lebanon)

Financial data not available.

Production facilities:

RICEBORO, GA.
(Interstate Paper Corp.)
Pulp—525 tpd kraft
Linerboard—550 tpd

READING, PA.
(Interstate Intercorr Corp.)
Corrugating medium—100 tpd

Total production capacity:

PULP	
Kraft	525 tpd
PAPERBOARD	
Linerboard	550 tpd
Corrugating medium	100 tpd
Total	650 tpd

Irving Forest Products Inc.

Box 3007
St. John, N.B. E2M 3H1
J.K. Irving, president

Financial data is not available.

Production facilities:

ST. JOHN, N.B.
(Irving Pulp & Paper Ltd.)
Pulp—725 metric tpd bleached and semibleached kraft (for market)

ST. JOHN, N.B.
(Rothesay mill)
Pulp—650 metric tpd groundwood, 272 tpd thermomechanical
Newsprint—865 metric tpd

ST. GEORGE, N.B.
(Lake Utopia Paper Ltd.)
Pulp—200 metric tpd semichemical
Corrugating medium—220 metric tpd

Total production capacity:

PULP	
Kraft	725 metric tpd
Groundwood	650 metric tpd
TMP	272 metric tpd
Semichemical	200 metric tpd
Total	1847 metric tpd
PAPER & BOARD	
Newsprint	865 metric tpd
Corrugating medium	220 metric tpd
Total	1085 metric tpd

James River Corp. of Virginia

Box 2218
Richmond, Va. 23217
Brenton S. Halsey, chairman/chief executive officer

Net sales:	
1982	$772,681,636
1981	561,318,000
Net earnings:	
1982	22,352,805
1981	21,356,000*

(fiscal year ended Apr. 25, 1982)
*Before extraordinary charge

James River's 1982 net sales were 38% higher than in 1981, primarily due to inclusion of the Brown Co. facilities in New Hampshire for a full year. The Brown acquisition (completed in Dec. 1980) gives James River the potential for vertical integration of its major raw material, pulp, and provides a timber base of 190,000 acres and cutting rights on 570,000 additional acres.

In 1981 James River acquired Minerva Inc., a wax paper/film products converter.

In mid-1982, James River acquired the U.S. paper mills of American Can Co., more than doubling the size of James River's facilities and moving the company heavily into production of tissue and bleached board products.

Since its organization in 1979, James River has grown through acquisitions. In mid-1982 its facilities comprised 4 pulp mills, 21 paper and board mills, 58 paper and board machines, and 32 converting plants. Annual pulp capacity is 820,000 tons, paper/board capacity 1,500,000 tons, converting capacity 900,000 tons.

Capital expenditures in 1981 totaled $21,800,000; planned expenditures for 1982 were $40,000,000.

Production facilities:

BUTLER, ALA.
(American Can, Naheola mill)
Pulp—1000 tpd kraft (some for market)
Solid bleached board—550 tpd
Tissue and towel—350 tpd

NEWARK, DEL.
(Curtis Paper Div.)
Printing/writing papers—24 tpd

JAY, MAINE
(James River-Otis Inc.)
Specialty papers—135 tpd

ADAMS, MASS.
(Curtis Paper Div.)
Specialty papers—35 tpd

EAST PEPPERELL, MASS.
(James River-Pepperell)
Specialty papers—75 tpd

FITCHBURG, MASS.
(James River-Fitchburg Inc.)
Specialty papers—60 tpd

FITCHBURG, MASS.
(James River-Massachusetts)
Specialty papers—300 tpd

KALAMAZOO, MICH.
(Board & Carton Group)
Paperboard—345 tpd

ROCHESTER, MICH.
(James River-Rochester Inc.)
Specialty papers—15 tpd

PARCHMENT, MICH.
(KVP Group)
Specialty papers—400 tpd

YPSILANTI, MICH.
(Peninsular Paper Co., Curtis Paper Div.)
Printing/writing papers—50 tpd

BERLIN, N.H.
(Berlin/Gorham Group)
Pulp—800 tpd kraft (about 300 tpd for market); 210 tpd semichemical
Corrugating medium—260 tpd

GORHAM, N.H.
(Berlin/Gorham Group)
Printing/industrial paper—350 tpd
Tissue/toweling—150 tpd

HUGHESVILLE, N.J.
(Riegel)
Specialty papers—250 tpd

RIEGELSVILLE, N.J.
(Riegel)
Specialty papers—15 tpd

WARREN GLEN, N.J.
(Riegel)
Specialty papers—80 tpd

HALSEY, ORE.
(Halsey Pulp Co., acquired from American Can; 50% owned by Pope & Talbot Inc.)
Pulp—350 tpd kraft (125 tpd for market)

HALSEY, ORE.
(American Can Co.)
Tissue and towel—220 tpd

BRISTOL, PA.
(Mill idle)

RICHMOND, VA.
(James River Paper Co., Papermaking Div.)
Specialty papers—26 tpd

Total production capacity:

PULP	
Kraft	1800 tpd
Semichemical	210 tpd
Total	2010 tpd
PAPER & BOARD	
Specialty grades	1431 tpd
Printing/writing	424 tpd
Tissue/toweling	720 tpd
Paperboard	345 tpd
Bleached paperboard	550 tpd
Corrugating medium	260 tpd
Total	2610 tpd

Kimberly-Clark Corp.

128 N. Lake St.
Neenah, Wis. 54956
Darwin E. Smith, chairman/chief executive officer

(Subsidiaries include Kimberly-Clark of Canada Ltd., 100% owned, and Spruce Falls Power & Paper Co. Ltd., 50.5%)

Net sales:	
1981	$2,886,000,000
1980	2,600,000,000
Net earnings:	
1981	204,700,000
1980	181,800,000

Sales/earnings data are for "consolidated operations"—those in which K-C has an interest of 50% or more.

K-C's tissue mills are included in the Consumer & Service class, which had an operating profit worldwide of $153,000,000 in 1981. Production of tissue at U.S. mills was 432,000 tons, 9.6% of U.S.-made tissue.

Newsprint, Pulp & Forest Products had an operating profit of $90,000,000 in 1981. K-C's production of newsprint in U.S. and Canada was 626,000 tons.

Paper & Specialties class operating profit in 1981 was $48,000,000. Production by K-C mills was: 42,000 tons thin papers, 108,000 tons other printing/business papers, and 15,000 tons of packaging/industrial converting paper.

Capital spending in 1981 amounted to $239,000,000. For 1982 capital spending was expected to be $350-400,000,000, covering projects in each of the major product classes but primarily in the Consumer & Service Class.

Kimberly-Clark owns 76,664 acres of timberland in U.S. and Canada and has an additional 11,810,178 acres under lease or license.

Production facilities:

COOSA PINES, ALA.
(Coosa River Newsprint)
Pulp—845 tpd kraft (540 tpd for market), 763 tpd groundwood, 110 tpd TMP
Newsprint, groundwood printing paper—1210 tpd

FULLERTON, CALIF.
Tissue—183 tpd

NEW MILFORD, CONN.
Tissue—198 tpd

LEE, MASS.
(Peter J. Schweitzer Div.)
Business/lightweight specialties—97 tpd

MUNISING, MICH.
Industrial specialties—100 tpd

ELIZABETH, N.J.
(Schweitzer Div.)
(Mill idle)

SPOTSWOOD, N.J.
(Schweitzer Div.)
Cigaret papers—138 tpd

ANGRAM, N.Y.
(Schweitzer Div.)
Plug wrap, reconstituted grades—15 tpd

MT. HOLLY SPRINGS, PA.
(Schweitzer Div.)
Capacitor paper—13 tpd

BEECH ISLAND, S.C.
Tissue—267 tpd

MEMPHIS, TENN.
Tissue—309 tpd

NEENAH, WIS.
(Lakeview)
Tissue—222 tpd

NEENAH, WIS.
(Badger-Globe)
Tissue—62 tpd

NEENAH, WIS.
(Neenah Paper Co.)
Writing, specialty papers—90 tpd

WHITING, WIS.
(former Plover Papers mill)
Business communication papers—40 tpd

ST. JOHN, N.B.
(K-C of Canada)
Tissue—42 metric tpd

HUNTSVILLE, ONT.
(K-C of Canada)
Tissue—100 metric tpd

KAPUSKASING, ONT.
(K-C of Canada)
Tissue & specialties—77 metric tpd

KAPUSKASING, ONT.
(Spruce Falls Power & Paper Co. Ltd.) (K-C owns 50.5%)
Pulp—635 metric tpd groundwood (K-C's share 321 tpd); 195 tpd TMP (K-C's share 98

tpd), 150 tpd calcium-base sulfite (K-C's share 76 tpd), 200 tpd magnefite (K-C's share 101 tpd) (35 tpd for market)

Newsprint, groundwood printing papers—915 metric tpd (K-C's share 462 metric tpd)

ST. CATHARINES, ONT.
(K-C of Canada)
Tissue & specialties—77 metric tpd

TERRACE BAY, ONT.
(K-C of Canada)
Pulp—1134 metric tpd kraft (for market)

Total production capacity:

PULP (short tons)		
Kraft		2095 tpd
Groundwood		1117 tpd
Sulfite		195 tpd
Thermomechanical		108 tpd
Total	3515 tpd	

PAPER (short tons)		
Newsprint		2219 tpd
Tissue		1567 tpd
Printing, writing & specialties		493 tpd
Total	4279 tpd	

Kruger Inc.

3285 Bedford Rd.
Montreal, Que. H3S 1G5
J.S. Hermon, president/chief executive officer

Financial data not available; but 100% of Kruger's sales are derived from paper products.

Production at Kruger's three mills in 1981 totaled 581,162 metric tons.

Production facilities:

BROMPTONVILLE, QUE.
(Newsprint Div.)
Pulp—381 metric tpd groundwood, 272 tpd TMP
Newsprint—562 metric tpd

MONTREAL, QUE.
(Turcot Paperboard Div.)
Recycled paperboard—272 metric tpd

TROIS-RIVIERES, QUE.
Pulp—680 metric tpd groundwood, 200 tpd sulfite, 145 tpd TMP
Newsprint—726 metric tpd
Coated publication paper—363 metric tpd

Total production capacity:

PULP		
Sulfite		200 metric tpd
Groundwood		1061 metric tpd
Thermomechanical		417 metric tpd
Total	1678 metric tpd	

PAPER & BOARD		
Newsprint		1288 metric tpd
Coated publication		363 metric tpd
Paperboard		272 metric tpd
Total	1923 metric tpd	

Longview Fibre Co.

Box 639
Longview, Wash. 90632
R.P. Wollenberg, president/chief executive officer

Net sales:	
1981	$389,450,000
1980	357,868,000
Net earnings:	
1981	11,261,000
1980	1,324,000
(fiscal year ending Oct. 31)	

Sales of paper/board in 1981 were $164,857,000, and converted products $193,669,000, accounting for 92% of Longview's total. Income from paper/board sales was $15,600,000; converted products operated at a loss of $4,592,000.

In 1981 Longview produced 347,000 tons of paper and 309,000 tons of paperboard; and 344,000 tons of converted products.

Capital spending in 1981 was $43,757,000 and about $48,000,000 was to be spent in 1982, including work on a lime kiln project and a new 1000-tpd digester.

Longview's timberlands include 15,000 acres under lease and 483,000 acres owned.

Production facilities:

LONGVIEW, WASH.
Pulp—2275 tpd kraft; 225 tpd semichemical
Packaging, industrial converting paper—1210 tpd
Unbleached kraft board—870 tpd
Semichemical board—200 tpd

Total production capacity:

PULP		
Kraft		2275 tpd
Semichemical		225 tpd
Total	2500 tpd	

PAPER & BOARD		
Packaging/industrial converting paper		1210 tpd
Unbleached kraft board		870 tpd
Semichemical board		200 tpd
Total	2280 tpd	

Louisiana-Pacific Corp.

1300 S.W. Fifth Ave.
Portland, Ore. 97201
Harry A. Merlo, chairman/president

(L-P established an "investment" position in 1981 in National Gypsum, purchasing about 12% interest)

Net sales:	
1981	$1,023,050,000
1980	1,195,590,000
Net earnings:	
1981	26,280,000*
1980	60,010,000

*Excludes extraordinary gain from U.S. government for timberlands taken for Redwood National Park

Sales of pulp, paperboard and containers in 1981 were $214,000,000, approximately 21% of L-P total. Pulp sales accounted for $130,000,000, and paperboard and containers for $84,000,000. Operations resulted in a $2,000,000 loss.

Production of market pulp in 1981 was 318,000 tons; and of paperboard 215,000 tons, hardboard was 138,000,000 ft²; medium-density fiberboard 106,000,000 ft².

Capital investment programs include a $40,000,000 boiler project at Antioch, Calif., expected to reduce mill energy costs about 40%.

L-P's timberlands include 920,000 acres owned and 1,890,000 acres controlled.

Production facilities:

KETCHIKAN, ALASKA
Pulp—600 tpd dissolving sulfite (for market)

ANTIOCH, CALIF.
(Container Products Div.)
Pulp—600 tpd kraft, 175 tpd semichemical
Paperboard and/or kraft pulp—800 tpd

OROVILLE, CALIF.
Pulp—defibrated
Hardboard—500,000 ft²/day (est. 140 tpd)

ROCKLIN, CALIF.
Pulp—defibrated
Medium-density fiberboard—230,000 ft²/day (est. 220 tpd)

SAMOA, CALIF.
Pulp—610 tpd kraft (for market)

Total production capacity:

PULP		
Dissolving		600 tpd
Kraft		1210 tpd
Semichemical		175 tpd
Total	1985 tpd	

PAPERBOARD	800 tpd

BUILDING BOARD	
Hardboard/fiberboard	360 tpd

MacMillan Bloedel Ltd.

1075 W. Georgia St.
Vancouver, B.C. V6E 3R9
C. Calvert Knudsen, chairman/chief executive officer

Net sales (C$):	
1981	$2,230,100,000
1980	2,456,200,000
Net earnings (C$):	
1981	3,300,000*
1980	113,200,000

*Extraordinary item

MB's 1981 operations resulted in a loss of C$26,700,000 prior to an extraordinary gain of $30,000,000 from sale of the 65% interest in MacMillan Rothesay to Irving interests in mid-1981. Gains in other sectors could not overcome the loss in building materials.

Sales of pulp and paper in 1981 were $830,900,000; contributions to earnings $92,100,000. Sales of containerboard and packaging were $524,500,000; contributions to earnings $31,400,000.

Production by grade at MB mills in 1981 was: newsprint/groundwood paper 961,000 metric tons (includes Rothesay mill until July, and new machine at Powell River); fine paper 34,000 tons; linerboard 363,000 tons; corrugating medium 68,000 tons; market pulp 342,000 tons.

Capital expenditures in 1981 totaled $397,900,000, of which $105,300,000 was for pulp and paper facilities and $133,200,000 for containerboard and packaging. Pending improved economic conditions, MB has substantially reduced its spending program. The Pine Hill containerboard expansion is proceeding as planned, with $44,000,000 to be spent. Completion of the Harmac recovery boiler and the fine paper machine at New Westminster have been deferred. MB total expenditures in 1982 are set at $240,000,000.

MB's timberlands comprise 425,000 acres in U.S. and 2,617,000 acres in Canada, for a total of 3,042,000 acres. In U.S. 156,000 acres are owned, 269,000 acres controlled; in Canada 556,000 acres are owned, 2,051,000 controlled.

Production facilities:

PINE HILL, ALA.
(MacMillan Bloedel Inc.)
Pulp—1000 short tpd unbleached kraft
Linerboard—1110 short tpd

NANAIMO, B.C.
(Harmac Div.)
Pulp—965 metric tpd kraft (for market)

NEW WESTMINSTER, B.C.
(Fine Papers Div.)
Fine papers—110 metric tpd

PORT ALBERNI, B.C.
(Alberni Pulp & Paper Div.)
Pulp—850 metric tpd kraft (160 tpd for market); 945 tpd groundwood (including RMP)
Newsprint—1070 metric tpd
Linerboard—312 metric tpd

POWELL RIVER, B.C.
(Powell River Div.)
Pulp—500 metric tpd kraft (70 tpd for market); 770 tpd groundwood; 700 tpd TMP, 45 tpd RMP
Newsprint/groundwood papers—1900 metric tpd

STURGEON FALLS, ONT.
Pulp—250 metric tpd semichemical
Corrugating medium—203 metric tpd
Hardboard—300,000 ft²/day

Total production capacity:

PULP	
Kraft	3222 metric tpd
Groundwood	1630 metric tpd
Thermomechanical	700 metric tpd
RMP	130 metric tpd
Semichemical	250 metric tpd
Total	5932 metric tpd
PAPER & BOARD	
Newsprint	2970 metric tpd
Containerboard	1522 metric tpd
Fine papers	110 metric tpd
Total	4602 metric tpd
BUILDING BOARD	
Hardboard	300,000 ft²/day

Manville Corp.

Ken-Caryl Ranch
Denver, Colo. 80217
John A. McKinney, chairman/chief executive officer

(Formerly Johns-Manville Corp.)

The pulp/paper mill at West Monroe, La., was acquired by Johns-Manville Corp. in 1979 and its name changed from Olinkraft to Manville Forest Products Corp. in mid-1980.

In 1981, paper/board sales were $554,612,000, 25% of the parent's $2,200,000,000. Production of paper/board was 646,209 tons.

Capital expenditures in 1981 were $24,200,000 and $37,500,000 were budgeted for 1982.

Manville owns 587,000 acres of timberlands.

In August 1982 Manville filed for reorganization under Chapter 11 of the federal bankruptcy code, citing the cost of asbestos health lawsuits filed against it. The company planned to continue operating its building materials and forest products operations.

Production facilities:

WEST MONROE, LA.
(Manville Forest Products Corp.)
Pulp—1400 tpd kraft, 270 tpd semichemical
Paperboard—140 tpd
Coated paperboard—1450 tpd
Kraft paper—120 tpd
Corrugating medium—330 tpd

Total production capacity:

PULP	
Kraft	1400 tpd
Semichemical	270 tpd
Total	1670 tpd
PAPER & BOARD	
Paperboard	1590 tpd
Kraft paper	120 tpd
Corrugating medium	330 tpd
Total	2040 tpd

Masonite Corp.

29 N. Wacker Dr.
Chicago, Ill. 60606
Robert N. Rasmus, president/chief executive officer

(Owns 50% of Masonite Canada Ltd.)

Net sales:	
1981	$537,500,000
1980	510,584,000
Net earnings:	
1981	27,115,000
1980	30,129,000

Sales of hardwood building products were $254,729,000, 47% of corporate total; asphalt roofing sales of $33,341,000 were 6% of total. Although sales increased modestly over 1980 levels, the three U.S. hardboard mills operated at about 75% of capacity in 1981.

In the roofing sector, the Little Rock, Ark., plant was sold and operations consolidated at Meridian, Miss., and New Orleans, La.

Production facilities:

UKIAH, CALIF.
Pulp—450 tpd defibrated
Hardboard—600 tpd

NEW ORLEANS, LA.
Pulp—50 tpd defibrated
Roofing felt—130 tpd

LAUREL, MISS.
Pulp—1560 tpd defibrated
Hardboard—1560 tpd

MERIDIAN, MISS.
Pulp—35 tpd defibrated
Roofing felt—90 tpd

TOWANDA, PA.
Pulp—500 tpd defibrated
Hardboard—500 tpd

SPRING HOPE, N.C.
Pulp—defibrated
Medium-density fiberboard—250 tpd

HUBBARDS, N.S.
(Masonite Canada—50% owned)
Pulp—325 short tpd defibrated (Masonite's ½ 162 tpd)
Hardboard—325 short tpd (Masonite's ½ 162 tpd)

GATINEAU, QUE.
(Masonite Canada—50% owned)
Pulp—150 short tpd defibrated (Masonite's ½ 75 tpd)
Hardboard—600,000 ft^2 day (Masonite's ½ 300,000 ft^2/day—est. 100 short tpd)

Total production capacity:

PULP (defibrated)	2832 short tpd
BUILDING BOARD	
Roofing felt	220 short tpd
Fiberboard	250 short tpd
Hardboard	2922 short tpd
Total	3392 short tpd

Mead Corp.

Courthouse Plaza Northeast
Dayton, Ohio 45463
Burnell R. Roberts, chairman/chief executive officer

(Escanaba Paper Co. is a wholly-owned subsidiary. Mead also has a 50% interest in Brunswick Pulp & Paper Co., Georgia Kraft Co., Northwood Forest Industries, and Schoeller Technical Papers Inc., and a 15.1% direct interest in British Columbia Forest Products in addition to the 13.2% held indirectly through Brunswick P&P)

Net sales:	
1981	$2,899,700,000
1980	2,707,200,000
Net earnings:	
1981	106,900,000
1980	128,600,000

Sales of Mead's Forest Products group in 1981 were 66% of total. Paper sales reached a record $710,600,000 and contributed 40% of operating profit; sales of pulp and wood products were $393,300,000, 12% of operating profit; packaging products/paperboard sales were $819,200,000, 23% of operating profit.

Production of paper and paperboard at Mead mills in 1981 was 2,243,000 tons; market pulp output was 493,000 tons.

Capital expenditures in 1981 for forest products facilities were $466,900,000, of which $258,300,000 was for paper operations. Three major projects were: the new paper machine at Chillicothe, Ohio (on line in fall 1981), a new coated paper machine at Escanaba, Mich. (started in May 1982) and doubling of bleached pulp at Northwood Pulp in B.C. (due end-1982). All are part of Mead's five-year $1,500,000,000 capital program begun in 1980. Total spending in 1981 was $503,300,000; spending in 1982 was expected to be $260-290,000,000.

Mead owns 1,593,000 acres of timberland in U.S., with 102,000 acres controlled, and controls an additional 2,000,000 acres in Canada.

Production facilities:

STEVENSON, ALA.
Pulp—600 tpd semichemical
Semichemical board—860 tpd

BRUNSWICK, GA.
(Brunswick Pulp & Paper)
Pulp—1735 tpd kraft (Mead's share 867 tpd; 220 tpd for market; Brunswick mill has swing capacity between board and pulp of 400 tpd solid bleached board)

KRANNERT, MACON, GA; MAHRT, ALA.
(Georgia Kraft Co.)
Unbleached kraft board—4457 tpd (Mead's share 2229 tpd)

SOUTH LEE, MASS.
Packaging, industrial converting paper—58 tpd

ESCANABA, MICH.
(Escanaba Paper Co.)
Pulp—741 tpd hardwood or 698 tpd combination hardwood and softwood kraft (225 tpd for market); 200 tpd refiner mechanical
Printing/writing paper—1314 tpd (includes new machine starting in mid-1982)

OTSEGO, MICH.
Combination (recycled) board—186 tpd

PULASKI, N.Y.
(Schoeller Technical Papers)
Packaging, industrial converting paper—70 tpd (Mead's share, 35 tpd)

CHILLICOTHE, OHIO
Pulp—657 tpd kraft
Printing/writing paper—1229 tpd

CINCINNATI, OHIO
Combination (recycled) board—171 tpd

KINGSPORT, TENN.
Pulp—286 tpd soda
Printing/writing paper—543 tpd

LYNCHBURG, VA.
Combination (recycled) board—400 tpd

MENASHA, WIS.
(Gilbert Paper Co. Div.)
Printing/writing paper—66 tpd

CROFTON, B.C.
(B.C. Forest Products Ltd.)
Pulp—839 metric tpd kraft (Mead's share 235 tpd)
Newsprint—1202 metric tpd (Mead's share 337 tpd)

MACKENZIE, B.C.
(B.C. Forest Products Ltd.)
Pulp—544 metric tpd kraft (Mead's share 152 tpd) (369 metric tpd kraft pulp for market—Crofton & Mackenzie combined)

MACKENZIE, B.C.
(Finlay Forest Products Ltd.)
Pulp—49 metric tpd refiner mechanical (Mead's share through BCFP interest)

PORT ALICE & SQUAMISH, B.C.
(Western Forest Products Ltd.)
Pulp—36 metric tpd dissolving sulfite; 45 tpd kraft (Mead's share through BCFP's interest)

PRINCE GEORGE, B.C.
(Northwood Pulp & Timber Co. Ltd.)
Pulp—725 metric tpd kraft (Mead's share 362.5 tpd; 145 tpd for market) (After expansion, late 1982, capacity will be 1450 metric tpd; Mead's share 725 tpd)

ST-FELICIEN, QUE.
(Donohue St-Felicien, through BCFP)
Pulp—690 metric tpd kraft (Mead's share 87 tpd for market through BCFP interest)

Total production capacity:

PULP (short tons)		
Kraft or soda		3493 tpd
Refiner mechanical		254 tpd
Semichemical		600 tpd
Dissolving sulfite		40 tpd
Total	4387 tpd	
PAPER (short tons)		
Newsprint		371 tpd
Packaging/industrial		93 tpd
Printing/writing		3152 tpd
Total	3616 tpd	
PAPERBOARD (short tons)		
Semichemical		860 tpd
Solid bleached		400 tpd
Kraft linerboard		2229 tpd
Recycled board		757 tpd
Total	4246 tpd	
PAPER & BOARD (short tons)		7862 tpd

National Gypsum Co.

1201 Elm St.
Dallas, Texas 75270
Robert L. Scifres, chairman/chief executive officer

(Acquired mill of Pacific Paperboard at Stockton, Calif., in mid-1981)

Gypsum board liner and insulation board produced by National Gypsum are included in Gold Bond Building Products Div. Financial data not available.

Production facilities:

ANNISTON, ALA.
Gypsum board liner—200 tpd

MOBILE, ALA.
Pulp—225 tpd groundwood
Insulation board—375 tpd

STOCKTON, CALIF.
Gypsum board liner—120 tpd
Chipboard—140 tpd

KALAMAZOO, MICH.
Gypsum board liner—150 tpd

PRYOR, OKLA.
Gypsum board liner—210 tpd

MILTON, PA.
Gypsum board liner—320 tpd

Total production capacity:

PULP (groundwood)	225 tpd
PAPERBOARD	
Gypsum board liner	1000 tpd
Chipboard	140 tpd
BUILDING (insulation board)	375 tpd

Newark Group Inc.

57 Freeman St.
Newark, N.J. 07105
Edward K. Mullen, president

(Newark Boxboard Co. is a subsidiary of Newark Group; California Paperboard Corp. is a subsidiary of Newark Boxboard; other paperboard mills are divisions of Newark Boxboard)

Financial data not available.

Production facilities:

SANTA CLARA, CALIF.
(California Paperboard Corp.)
Recycled paperboard—200 tpd

UNCASVILLE, CONN.
(Connecticut Paperboard Corp. Div.)
Corrugating medium—180 tpd

HAVERHILL, MASS.
(Haverhill Paperboard Co. Div.)
Recycled paperboard—300 tpd

NATICK, MASS.
(Natick Paperboard Co. Div.)
Recycled paperboard—100 tpd

NEWARK, N.J.
(Newark Mill)
Recycled paperboard—110 tpd

MIDDLETOWN, OHIO
(Middletown Paperboard Co. Div.)
Recycled paperboard—130 tpd

MILWAUKEE, WIS.
(Wisconsin Paperboard Corp. Div.)
Recycled paperboard—250 tpd

Total production capacity:

PAPERBOARD	1270 tpd

Noranda Mines Ltd.

Box 45, Commerce Court W.
Toronto, Ont. M5L 1B6
Alfred Powis, chairman/president

(Noranda owns 100% of Northwood Mills; Northwood Mills owns 100% of James Maclaren Industries Inc., 63% of Fraser Inc., 50% of Northwood Forest Industries Ltd. and 49.8% of MacMillan Bloedel Ltd. See separate listings for Fraser and MacMillan Bloedel.

Noranda acquired its 49.8% interest in MacMillan Bloedel in April 1981, and in May sold its 28% in B.C. Forest Products Ltd.)

In 1981, Noranda forest products interests aggregated C$2,701,000,000 of sales, of which Noranda's share was $1,474,000,000. Noranda's share of operating profits was $21,000,000.

Noranda's share of sales in 1980 was $851,000,000, and operating profit share was $74,000,000.

Noranda's share of production in 1981 was 403,000 metric tons of market pulp, 740,000 tons of newsprint and paper, 161,000 tons of containerboard.

Northwood Pulp & Timber produced 207,000 metric tons of market pulp in 1981, its output affected by the B.C. strike.

The Maclaren mills produced 163,000 tons of newsprint and 113,000 tons of market pulp in 1981. Maclaren strengthened its raw material base by acquiring 50% of Maniwaki Industries, a lumber, veneer and flooring producer, and also 27% of Normick Perron, a producer of lumber, plywood and waferboard.

Capital spending in 1981 for Noranda's forest products facilities totaled $593,000,000; Noranda's share was $302,000,000. Major program is doubling of pulp capacity at Northwood Pulp & Timber, due for completion in fall 1982, at estimated total cost of $375,000,000.

Timberlands managed by Maclaren include 40,000 acres owned, 1,812,000 acres controlled; timberlands for Northwood Pulp comprise 2000 acres owned, 2,698,000 acres controlled.

Adding in timberlands owned or controlled by Fraser and MacMillan Bloedel, the Noranda forest products interests have cutting access to 10,438,000 acres.

Production facilities:

PRINCE GEORGE, B.C.
(Northwood Pulp & Timber)
Pulp—725 metric tpd bleached kraft (Noranda's share 362.5 tpd (for market) (by end-1982, capacity to total 1450 tpd)

MASSON, QUE.
(James Maclaren Co.)
Pulp—380 metric tpd groundwood; 118 tpd sulfite
Newsprint—430 metric tpd

THURSO, QUE.
(Thurso Pulp & Paper Co., subsidiary of Maclaren)
Pulp—300 metric tpd bleached kraft (for market)

Total production capacity:

PULP	
Kraft	663 metric tpd
Groundwood	380 metric tpd
Sulfite	118 metric tpd
Total	1161 metric tpd
PAPER	
Newsprint	430 metric tpd

Nova Scotia Forest Industries

Box 59
Port Hawkesbury, N.S. B0E 2V0
Ralph C. Keef, resident manager/chairman

(Wholly-owned subsidiary of Stora Kopparberg of Sweden)

Net sales (C$):	
1981	$147,000,000
1980	143,000,000

Production in 1981 was 153,000 metric tons of newsprint, and 139,000 tons of market pulp.

Capital expenditures in 1981 were C$17,000,000.

Production facilities:

POINT TUPPER, N.S.
Pulp—454 metric tpd sulfite (for market); 109 tpd high-yield sulfite; 381 tpd groundwood
Newsprint—454 metric tpd

Total production capacity:

PULP	
Sulfite	454 metric tpd
High-yield sulfite	109 metric tpd
Groundwood	381 metric tpd
Total	944 metric tpd
PAPER	
Newsprint	454 metric tpd

Ontario Paper Co. Ltd.

80 King St., P.O. Box 3026
St. Catharines, Ont. L2R 7G2
Robert M. Schmon, chairman/chief executive officer

(Ontario Paper and its wholly-owned subsidiary, Q.N.S. Paper Co. Ltd., are both owned by the Chicago-based Tribune Co.)

Net sales (U.S.$):	
1981	$312,671,000
1980	288,743,000

About 80% of total sales are derived from pulp and paper, and 90% from exports.

Production of newsprint in 1981 by the two mills was 606,266 metric tons. Production of pulp was 576,903 tons, of which 15,500 tons were for market.

Capital expenditures in 1981 were C$165,843,000, and were planned to be $66,000,000 in 1982. Ontario Paper was completing in mid-1982 a major (two new newsprint machines) expansion at Thorold, and at Baie Comeau was planning a pioneering Opco pulp line for 1984 operation.

Production facilities:

THOROLD, ONT.
Pulp—365 metric tpd thermomechanical; 165 tpd chemimechanical; 230 tpd deinked news; 195 tpd unbleached sulfite (35 tpd for market)
Newsprint—900 metric tpd
(by end-1982, to be 977 tpd newsprint, 185 tpd groundwood specialties)

BAIE COMEAU, QUE.
(Q.N.S. Paper Co. Ltd.)
Pulp—1200 metric tpd groundwood; 350 tpd sulfite
Newsprint—1400 metric tpd

Total production capacity:

PULP	
Groundwood	1200 metric tpd
TMP	365 metric tpd
CMP	165 metric tpd
Deinked news	230 metric tpd
Unbleached sulfite	545 metric tpd
Total	2505 metric tpd
PAPER	
Newsprint	2300 metric tpd

Owens-Illinois Inc.

Box 1035
Toledo, Ohio 43666
William Laimbeer, vice president, forest products group

Sales of O-I's packaging operations in 1981 totaled $2,428,600,000, of which Forest Products Div. sales were $824,000,000. O-I claims this division is the largest producer of corrugating medium in U.S., and sixth largest producer of linerboard.

In 1982 O-I reorganized its operations and staff functions along product lines worldwide. The new forest products group includes the former Forest Products Div. (U.S. paper mills and container plants) plus containerboard and box operations in Mexico and France. In 1981, O-I sold the major segments of its Lily Div.

The division owns or leases more than 1,000,000 acres of timberland.

Production facilities:

VALDOSTA, GA.
(Forest Products Div.)
Pulp—900 tpd kraft
Linerboard—850 tpd

GRANGE, TEXAS
(Forest Products Div.)
Pulp—1175 tpd kraft
Linerboard—1120 tpd

BIG ISLAND, VA.
(Forest Products Div.)
Pulp—575 tpd semichemical
Corrugating medium—620 tpd

TOMAHAWK, WIS.
(Forest Products Div.)
Pulp—840 tpd semichemical
Corrugating medium—1000 tpd

Total production capacity:

PULP	
Kraft	2075 tpd
Semichemical	1415 tpd
Total	3490 tpd
PAPERBOARD	
Linerboard	1970 tpd
Corrugating medium	1620 tpd
Total	3590 tpd

Packaging Corp. of America

1603 Orrington Ave.
Evanston, Ill. 60204
Monte R. Haymon, president/chief executive officer

(Subsidiary of Tenneco Inc.)

Net sales:	
1981	$650,000,000
1980	588,000,000
Pretax income:	
1981	49,000,000
1980	31,000,000

Production of PCA's seven paperboard mills in 1981 totaled 1,156,426 tons. Containerboard output (at Counce and Filer City) increased to a record of 838,892 tons; output of recycled board was 317,534 tons. Consumption of wastepaper by mills and molded pulp plants was 419,402 tons.

Capital spending at PCA facilities in 1981 was $34,000,000; planned spending in 1982 was for $46,000,000.

PCA's timberlands comprises 442,452 acres owned and 228,824 acres controlled.

Production facilities:

DENVER, COLO.
Combination (recycled) board—130 tpd

MACON, GA.
Molded pulp products

GRIFFITH, IND.
Molded pulp products

TAMA, IOWA
Combination (recycled) board—100 tpd

HUTCHINSON, KANS.
Combination (recycled) board—220 tpd

FILER CITY, MICH.
Pulp—720 tpd semichemical
Corrugating medium—720 tpd

RITTMAN, OHIO
Combination (recycled) board—460 tpd

DELAWARE GAP, PA.
Combination (recycled) board—110 tpd

COUNCE, TENN.
(Tennessee River Pulp & Paper Co.)
Pulp—1600 tpd kraft
Linerboard—1650 tpd

Total production capacity:

PULP	
Kraft	1600 tpd
Semichemical	720 tpd
Total	2320 tpd
PAPERBOARD	
Combination (recycled) board	1020 tpd
Corrugating medium	720 tpd
Linerboard	1650 tpd
Total	3390 tpd

Parsons & Whittemore Inc.

200 Park Ave.
New York, N.Y. 10017
Carl C. Landegger, chairman

Financial data not available.

P&W's 70% interest in the Prince Albert Pulp mill in Saskatchewan was purchased in late 1980 by the Saskatchewan government (giving 100% ownership to the province). In early 1981, P&W's Watervliet printing paper mill in Watervliet, Mich., was sold to Howard Paper Mills.

A C$60,000,000 expansion program is underway at the St. Anne Nackawic mill, designed to add 14,000 metric tpy bleached kraft pulp by 1984.

Production facilities:

CLAIBORNE, ALA.
(Alabama River Pulp Co.)
Pulp—1000 tpd bleached kraft (for market)

NACKAWIC, N.B.
(St. Anne-Nackawic Pulp & Paper Co. Ltd.)
Pulp—635 metric tpd bleached hardwood kraft (for market)

Total production capacity:

PULP	1700 short tpd

Pentair Inc.

1700 W. Highway 36
St. Paul, Minn. 55113
D. Eugene Nugent, president/chief executive officer

(Wholly-owned subsidiaries are Niagara of Wisconsin Paper Corp., Miami Paper Corp., and Flambeau Paper Corp.)

Net sales:	
1981	$223,982,000
1980	210,852,000
Net earnings:	
1981	8,152,000
1980	12,303,000

Sales by Niagara of Wisconsin in 1981 were $91,500,000 and shipments were 150,000 tons of publication papers. Capital improvements at this mill in 1981 were $8,200,000.

Sales of Miami Paper were $48,100,000 in 1981 and shipments were 60,000 tons of publishing grades. Capital improvements were $2,000,000.

Sales of Flambeau Paper in 1981 were $70,200,000 and 97,000 tons of fine papers were shipped. Capital investments were $12,200,000.

Production of paper at the three mills in 1981 was 316,000 tons. Total capital expenditures were $22,400,000; $13,000,000 was to be spent in 1982.

Production facilities:

WEST CARROLLTON, OHIO
(Miami Paper Corp.)
Pulp—135 tpd deinked
Printing/publication paper—250 tpd

NIAGARA, WIS.
(Niagara of Wisconsin Paper Corp.)
Pulp—225 tpd groundwood
Printing/publication paper—500 tpd

PARK FALLS, WIS.
(Flambeau Paper Co.)
Pulp—125 tpd sulfite
Fine papers—325 tpd

Total production capacity:

PULP		
Deinked		135 tpd
Groundwood		225 tpd
Sulfite		125 tpd
Total	485 tpd	
PAPER		
Printing/publication		750 tpd
Fine paper		325 tpd
Total	1075 tpd	

Potlatch Corp.

One Maritime Plaza
San Francisco, Calif. 94111
Richard B. Madden, chairman/chief executive officer

Net sales:	
1981	$880,493,000
1980	818,301,000
Net earnings:	
1981	57,804,000
1980	48,751,000

Potlatch sales of pulp, paperboard and packaging in 1981 were $342,563,000; coated and uncoated printing/business papers $203,757,000; consumer products (including tissue and paper plateware) $100,356,000. Together pulp, paper/board and converted products accounted for 73% of 1981 sales.

Production at Potlatch mills in 1981 totaled 858,000 tons of paper/board: 504,200 tons of bleached paperboard; 235,667 tons of printing/business paper; 116,008 tons of tissue/toweling. Pulp output totaled 724,560 tons.

Capital spending in 1981 was $217,911,000, and $88,900,000 was to be spent in 1982. Major program is at Northwest Paper in Cloquet, Minn., with modernizations in both pulp and papermaking operations.

Potlatch owns 1,415,344 acres of timberland.

Production facilities:

McGEHEE, ARK.
Pulp—480 tpd bleached kraft (small amount for market)
Bleached paperboard—525 tpd

LEWISTON, IDAHO
(Paperboard Div.)
Pulp—1100 tpd bleached kraft (some for market)
Bleached paperboard—905 tpd

LEWISTON, IDAHO
(Consumer Products Div.)
Tissue—225 tpd

BRAINERD, MINN.
(Northwest Paper Div.)
Printing/business paper—370 tpd

CLOQUET, MINN.
(Northwest Paper Div.)
Pulp—480 tpd bleached kraft
Printing/business paper—350 tpd

RANSOM, PA.
(Consumer Products Div.)
Pulp—120 tpd deinked
Tissue—120 tpd

Total production capacity:

PULP		
Bleached kraft		2060 tpd
Reclaimed bleached		120 tpd
Total	2180 tpd	
PAPER & BOARD		
Printing/business paper		720 tpd
Paperboard		1430 tpd
Tissue		345 tpd
Total	2495 tpd	

Procter & Gamble Co.

Box 599
Cincinnati, Ohio 45201
James M. Edwards, vice president, Paper Products Div.
Robert E. Cannon, vice president, Cellulose Operations

(Wholly-owned subsidiaries are Procter & Gamble Paper Products Co., Buckeye Cellulose Corp., Procter & Gamble Cellulose Ltd.)

Financial data for P&G's papermaking operations are not available.

A modernization program at the Memphis, Tenn., pulp mill includes a 200-tpd Pandia continuous digester.

Production facilities:

OXNARD, CALIF.
(Procter & Gamble Paper)
Tissue grades

FOLEY, FLA.
(Buckeye Cellulose Corp.)
Pulp—1000 tpd dissolving and paper-grade kraft

ALBANY, GA.
(Procter & Gamble Paper)
Tissue grades

CHEBOYGAN, MICH.
(Procter & Gamble Paper)
Tissue grades

MEHOOPANY, PA.
(Procter & Gamble Paper)
Pulp—sulfite
Tissue grades

MEMPHIS, TENN.
(Buckeye Cellulose Corp.)
Pulp—280 tpd cotton linter

GREEN BAY, WIS.
(Procter & Gamble Paper)
Pulp—sulfite
Tissue grades

GRANDE PRAIRIE, ALTA.
(Procter & Gamble Cellulose)
Pulp—750 metric tpd kraft

Total production capacity:

PULP (short tons)	
Cotton linter	280 tpd

Kraft		1826 tpd
Sulfite		n.a.
Total	2100 tpd	
PAPER		
Tissue		(est. 2750 tpd)

Publishers Paper Co.

4000 Kruse Way Place
Lake Oswego, Ore. 07034
Jack E. Meadows, president/chief executive officer

Net sales:	
1981	$324,391,000
1980	296,319,000
Operating profit:	
1981	−1,590,000
1980	−7,484,000

Newsprint operations were responsible for the improved results in 1981 vs 1980, to some extent offsetting the disastrous forest products decline. Paper sales were 68% of Publishers total.

Production of newsprint reached 537,349 tons, a 34% increase over 1980 due to the new machine at Newberg which began operating in late 1980. Market pulp production was 3630 tons.

Capital spending in 1981 was $59,936,000, with $61,111,000 scheduled for 1982.

Timber acreage owned is 272,000 acres.

Production facilities:

NEWBERG, ORE.
(Newberg Div.)
Pulp—250 tpd sulfite (150 tpd for market); 650 tpd refiner mechanical; 200 tpd deinked
Newsprint—1000 tpd

OREGON CITY, ORE.
Pulp—200 tpd sulfite, 435 tpd refiner mechanical; 150 tpd deinked
Newsprint—650 tpd

Total production capacity:

PULP		
Sulfite		450 tpd
Refiner mechanical		1085 tpd
Deinked		350 tpd
Total	1885 tpd	
PAPER		
Newsprint		1650 tpd

Reed Paper Ltd.

145 King St. W.
Toronto, Ont. M5H 1J8
D.A. MacIver, president/chief executive officer

(Approximately 87% of Reed Paper shares are held by Reed Paper Holdings, Ltd., a subsidiary of Reed International Ltd. of U.K.)

Financial data not available.

In late-1981, Reed announced a C$200,000,000 program to improve efficiency, add capacity to newsprint and paperboard operations and reduce pollution problems. Target date is 1986.

Production facilities:

QUEBEC CITY, QUE.
Pulp—680 metric tpd groundwood, 450 tpd sulfite (140 tpd for market))
Newsprint—910 metric tpd
Paperboard—85 metric tpd

Total production capacity:

PULP		
Groundwood		680 metric tpd
Sulfite		450 metric tpd
Total	1130 metric tpd	
PAPER & BOARD		995 metric tpd

St. Joe Paper Co.

803 First National Bank Bldg.
Jacksonville, Fla. 32456
J.C. Belin, president/chief executive officer

St. Joe is a privately owned company; financial data not available.

Capital expenditures in 1981 were $29,000,000 and $18,000,000 was to be spent in 1982. A five-year energy-conservation program which will also increase linerboard capacity by 60,000 tpy is due for 1984 completion.

Production facilities:

PORT ST. JOE, FLA.
Pulp—1700 tpd kraft
Unbleached kraft linerboard—1200 tpd

Total production capacity:

PULP	1700 tpd
PAPERBOARD	1200 tpd

St. Regis Paper Co.

237 Park Ave.
New York, N.Y. 10017
William R. Haselton, president/chief executive officer

(St. Regis (Alberta) Ltd. is a wholly-owned subsidiary)

Net sales:	
1981	$2,818,798,000
1980	2,714,070,000
Net earnings:	
1981	179,218,000
1980	177,388,000

Pulp, paper/board and converted production accounted for 86% of St. Regis 1981 sales. Sales (including intersegment) of kraft and recycled fiber products were $829,000,000; printing paper $532,000,000; newsprint $294,000,000; packaging and converted products $990,000,000.

Production of pulp in 1981 by St. Regis was 3,000,000 tons, of which 210,000 tons were sold as market pulp. Output of kraft linerboard was 897,000 tons; recycled fiber medium 190,000 tons; recycled paperboard 174,000 tons; kraft papers 589,000 tons; printing papers 774,000 tons; newsprint 710,000 tons; packaging and specialty papers 43,000 tons. Total paper/board production was 3,377,000 tons.

Capital expenditures in 1981 were $437,689,000; spending in 1982 was to be $369,977,000 (excluding timberlands and leased property). Biggest program was at Pensacola, Fla., with startup in 1981 of a new 236,000-tpy kraft paper machine.

St. Regis' timberlands total nearly 6,000,000 acres in U.S. and Canada; 3,211,000 acres owned and 866,000 acres controlled in U.S.; 1,908,000 acres controlled in Canada.

Production facilities:

JACKSONVILLE, FLA.
(Kraft Div.)
Pulp—1383 tpd kraft
Industrial converting paper—363 tpd
Unbleached kraft board—954 tpd

PENSACOLA, FLA.
(Kraft Div.)
Pulp—932 tpd kraft (71 tpd fluffing pulp for market)
Industrial converting paper—1345 tpd

BUCKSPORT, MAINE
(Printing Paper Div.)
Pulp—300 tpd groundwood, 146 tpd thermomechanical
Printing/writing paper—1162 tpd

BATTLE CREEK, MICH.
(Recycled Fiber Div.)
Combination (recycled) board—500 tpd

SARTELL, MINN.
(Printing Paper Div.)
Pulp—130 tpd groundwood; 400 tpd thermomechanical
Printing/writing paper—721 tpd
(new machine adds 480 tpd in mid-1982)

MONTICELLO, MISS.
(Kraft Div.)
Pulp—1748 tpd kraft
Industrial converting paper—413 tpd
Unbleached kraft board—1234 tpd

DEFERIET, N.Y.
(Printing Paper Div.)
Pulp—320 tpd groundwood
Printing/writing paper—618 tpd

COLUMBUS, OHIO
(Printing Paper Div.)
Packaging paper—45 tpd

COSHOCTON, OHIO
(Recycled Fiber Div.)
Combination (recycled) board—150 tpd

YORK, PA.
(Recycled Fiber Div.)
Combination (recycled) board—332 tpd

HOUSTON, TEXAS
(Newsprint Div.)
Pulp—650 tpd kraft, 740 tpd groundwood; 400 tpd thermomechanical
Newsprint—1451 tpd

LUFKIN, TEXAS
(Newsprint Div.)
Pulp—400 tpd kraft, 830 tpd groundwood
Newsprint—1075 tpd
Printing paper—138 tpd

TACOMA, WASH.
(Kraft Div.)
Pulp—1060 tpd kraft (217 tpd for market)
Industrial converting paper—292 tpd
Unbleached kraft & solid bleached board—486 tpd

HINTON, ALTA.
(St. Regis (Alberta) Ltd.)
Pulp—513 metric tpd kraft (for market)

Total production capacity:

PULP (short tons)		
Thermomechanical		946 tpd
Kraft		6738 tpd
Groundwood		2320 tpd
Total	9601 tpd	

PAPER & BOARD		
Newsprint		2526 tpd
Printing/writing		2639 tpd
Packaging paper		45 tpd
Industrial converting		2413 tpd
Unbleached kraft and solid bleached board		2674 tpd
Combination board		982 tpd
Total	11,279 tpd	

Scott Paper Co.

Scott Plaza
Philadelphia, Pa. 15113
Phillip E. Lippincott, president/chief executive officer

(Scott has a 50% share in the joint-venture Brunswick Pulp & Paper Co.; Brunswick in turn has a 26% interest in British Columbia Forest Products Ltd. Scott Maritimes Ltd. is a wholly-owned subsidiary of Scott Paper International Inc., a wholly-owned subsidiary of Scott Paper Co. In spring 1981 Brascan Ltd. acquired a 20.5% interest in Scott.)

Net sales:	
1981	$2,309,444,000
1980	2,083,235,000
Net earnings:	
1981	133,340,000
1980	132,998,000

Sales of the Packaged Products Div. in 1981 were $1,602,541,000 and of S.D. Warren Div., $584,405,000. Sales of forest products and pulp in 1981 are included in Packaged Prods. sales ($120,910,000) and S.D. Warren Sales ($20,288,000).

In late 1981 Scott established a Natural Resources Div., including U.S. and Canadian woodlands, Scott Maritimes pulp mill in Nova Scotia and Scott's interest in Brunswick P&P and a Brazilian forestry venture, fiber operations, and oil, gas and minerals interests. Responsibility for the Skowhegan, Maine, pulp mill and new paper machine has been assumed by the Warren division.

In early 1981 Scott embarked on a 1981-85 "Strategic Program" designed to improve profitability in "core" businesses where it has unique competitive strengths. The program is budgeted at $1,600,000,000 for domestic capital expansions and improvements. In 1981, U.S. capital spending was $321,099,000 and was expected to be $450,000,000 in 1982 and $850,000,000 in the succeeding three years.

Scott owns 3,300,000 acres of timberlands in U.S., Canada and Brazil.

Production facilities:

(Scott does not release capacity data information below is estimated and incomplete)

MOBILE, ALA.
(Southern Operations)
Pulp—1400 tpd kraft; also deinked
Tissue—750 tpd
Other paper grades—750 tpd

BRUNSWICK, GA.
(Brunswick Pulp & Paper)
Pulp—1700 tpd kraft (1300 tpd for market) (Scott's share: 850 tpd)
Bleached paperboard—400 tpd (Scott's share: 200 tpd)

SKOWHEGAN, MAINE
(S.D. Warren Div.)
Pulp—800 tpd bleached kraft (for market)
(Paper—565 tpd coated free-sheet; due on-line 1983)

WESTBROOK, MAINE
(S.D. Warren Div.)
Pulp—295 tpd bleached kraft
Fine papers—550 tpd

WINSLOW, MAINE
(S.D. Warren Div.)
Pulp—sulfite **(pulp mill idle)**
Paper—850 tpd tissue, toweling, waxing, coating-base, specialty

MUSKEGON, MICH.
(S.D. Warren Div.)
Pulp—230 tpd bleached kraft
Fine papers—400 tpd

FORT EDWARD, N.Y.
Tissue—180 tpd

CHESTER, PA.
Tissue—1060 tpd

EVERETT, WASH.
(Northwest Operations)
Pulp—650 tpd sulfite (some for market)
Tissue—450 tpd

MARINETTE, WIS.
Tissue—350 tpd

OCONTO FALLS, WIS.
(Mill idle)

NEW WESTMINSTER, B.C.
(Scott Paper Ltd.)
Pulp—63 metric tpd
Tissue—145 metric tpd

PICTOU, N.S.
(Scott Maritimes Pulp)
Pulp—540 metric tpd bleached kraft (for market)

CRABTREE, QUE.
(Eastern Mfg. Div.)
Pulp—90 metric tpd deinked
Tissue—159 metric tpd

LENNOXVILLE, QUE.
(Eastern Mfg. Div.)
Pulp—45 metric tpd deinked
Tissue—45 metric tpd

Total production capacity:

PULP (short tons)		
Kraft		4175 tpd
Sulfite		650 tpd
Groundwood		70 tpd
Deinked		150 tpd
Total	5045 tpd	

PAPER & BOARD (short tons)		
Tissue		3855 tpd
Fine papers		950 tpd
Other paper grades		750 tpd
Paperboard		200 tpd
Total	5755 tpd	

Simpson Paper Co.

One Post St.
San Francisco, Calif. 94104
John Fannon, president

(Wholly-owned subsidiary of Simpson Timber Co.; owns 50% of Crown Simpson Co.)

Financial data not available.

Production facilities:

ANDERSON, CALIF.
Pulp—200 tpd kraft (some for market)
Printing/writing paper—375 tpd

FAIRHAVEN, CALIF.
(Crown Simpson Co.)
Pulp—300 tpd kraft (market) (Simpson's share)

POMONA, CALIF
Pulp—50 tpd deinked
Printing/writing paper—280 tpd

RIPON, CALIF
Pulp—20 tpd deinked
Printing/writing paper—90 tpd

VICKSBURG, MICH
Printing/writing paper—100 tpd

MIQUON, PA
Fine papers—140 tpd

Total production capacity:

PULP		
Kraft	500 tpd	
Deinked	70 tpd	
Total		570 tpd

PAPER		
Printing/writing	845 tpd	
Fine paper	140 tpd	
Total		985 tpd

Sonoco Products Co.

North Second St.
Hartsville, S.C. 29550
Charles W. Coker, Jr., president/chief executive officer

(Owns Sonoco Ltd. and controlling interest in St. Lawrence Pulp & Paper Co.)

Net sales:	
1981	$533,349,000
1980	490,397,000
Net earnings:	
1981	38,491,000
1980	32,511,000

Sonoco's returns in 1981 reflected an 18.4% increase in income on an 8.8% increase in sales. Production of paperboard was 612,443 tons.

In 1981, Sonoco purchased an 80% interest in the St. Lawrence deinked pulp mill at Ogdensburg, N.Y. (Potsdam Paper retains a minority holding), and began production in first-half of 1982.

Capital expenditures in 1981 were $35,700,000, and was projected at $32,000,000 for 1982, exclusive of acquisitions.

Sonoco owns 18,000 acres of timberland in U.S. and controls 22,000 acres.

Production facilities:

CITY OF INDUSTRY, CALIF
Paperboard—63 tpd

RICHMOND, CALIF
Paperboard—72 tpd

ATLANTA, GA
Paperboard—109 tpd

ROCKTON, ILL
Paperboard—62 tpd

HOLYOKE, MASS
Paperboard—215 tpd

AMSTERDAM, N.Y.
Paperboard—60 tpd

OGDENSBURG, N.Y.
(St. Lawrence Pulp & Paper)
Pulp—110 tpd deinked (for market)

LANCASTER, OHIO
Paperboard—73 tpd

MUNROE FALLS, OHIO
Paperboard—64 tpd

DOWNINGTOWN, PA
Paperboard—164 tpd

HARTSVILLE, S.C.
Pulp—280 tpd semichemical
Corrugating medium—500 tpd
Paperboard—520 tpd

NEWPORT, TENN
Paperboard—200 tpd

SUMNER, WASH
Paperboard—65 tpd

BRANTFORD, ONT
(Sonoco Ltd.)
Paperboard—122 metric tpd

TERREBONNE, QUE
(Sonoco Ltd.)
Paperboard—50 metric tpd

Total production capacity:

PULP (short tons)		
Semichemical	280 tpd	
Deinked	110 tpd	
Total		390 tpd

PAPERBOARD (short tons)		
Paperboard	1857 tpd	
Corrugating medium	500 tpd	
Total		2357 tpd

Southwest Forest Industries Inc.

Box 7548
Phoenix, Ariz. 85011
W.A. Franke, president/chief executive officer

Net sales:	
1981	$779,461,000
1980	737,938,000
Net earnings:	
1981	18,420,000*
1980	32,263,000

*Extraordinary item

SWF's net income for 1981 was down 43% from 1980 on a 6% increase of sales. Approximately 52% of sales were derived from pulp, paper/board and converted products. Operating income for paper products was 82% of total.

Shipments from SWF mills in 1981 were 847,000 tons, of which 455,000 tons were linerboard, 155,000 tons newsprint, and 237,000 tons market pulp.

SWF capital spending in 1981 totaled $78,500,000, of which $35,400,000 was for paper products. Expenditures in 1982 were expected to be $32,000,000, with $24,000,000 for paper facilities. In mid-1982 SWF completed a $45,000,000 conversion of one of two linerboard machines at the Snowflake mill into a second twin-wire newsprint machine. This resulted in a 120,000 tpy increase in newsprint and a 120,000-tpy decrease in linerboard capacity.

Southwest Forest owns 453,000 acres of timberlands and controls an additional 177,000 acres.

Production facilities:

SNOWFLAKE, ARIZ
Pulp—700 tpd kraft, 180 tpd groundwood, 550 tpd deinked news
Newsprint—800 tpd
Kraft linerboard—420 tpd

PANAMA CITY, FLA
Pulp—1450 tpd kraft (650 tpd bleached for market)
Linerboard—800 tpd

Total production capacity:

PULP		
Kraft	2150 tpd	
Mechanical groundwood	180 tpd	
Deinked news	550 tpd	
Total		2880 tpd

PAPER & BOARD		
Newsprint	800 tpd	
Kraft linerboard	1220 tpd	
Total		2020 tpd

Stone Container Corp.

360 N. Michigan Ave.
Chicago, Ill. 60601
Roger W. Stone, president/chief executive officer

Net sales:	
1981	$411,051,000
1980	379,188,000
Net earnings:	
1981	23,964,000
1980	21,255,000

Stone Container's net income in 1981 rose 12.7% on a sales increase of 8.4%. Paperboard sales of $165,000,000 were 40% of company total; corrugated container sales of $234,000,000 were 57% of total.

Production of paper/board in 1981 was 785,600 tons. The Florence mill produced 438,200 tons of kraft linerboard and 10,018 tons of kraft paper. Coshocton produced

246,100 tons of corrugating medium. Franklin and Mobile mills produced 101,300 tons of recycled paperboard.

Stone Container invested $67,778,000 for capital additions and improvements in 1981, the largest project being the third paperboard machine at Florence, S.C., which started up in late-1981. Major current project is a waste-to-energy facility at the Coshocton mill. Long-term plans are to increase production at the Florence mill to 740,000 tpy by 1986, and to increase long-term control of timberlands to 475,000 acres.

Production facilities:

MOBILE, ALA.
Boxboard—160 tpd

COSHOCTON, OHIO
Pulp—600 tpd semichemical
Corrugating medium—750 tpd

FRANKLIN, OHIO
Boxboard—160 tpd

FLORENCE, S.C.
(South Carolina Industries)
Pulp—1350 tpd
Linerboard—1650 tpd

Total production capacity:

PULP		
Semichemical		600 tpd
Unbleached kraft		1350 tpd
Total	1950 tpd	

PAPERBOARD		
Linerboard		1650 tpd
Corrugating medium		750 tpd
Boxboard		320 tpd
Total	2720 tpd	

Superwood Corp.

14th Ave. W. & Waterfront
Duluth, Minn. 55806
K.V. Hafner, president

Net sales:	
1981	$60,314,000
1980	49,925,400

Superwood is a privately-owned company and does not provide detailed financial data.

Hardboard production in 1981 was 215,032 tons.

Production facilities:

NORTH LITTLE ROCK, ARK.
(North Little Rock Div.)
Pulp—140 tpd defibrated
Hardboard—140 tpd

BEMIDJI, MINN.
(Nu-Ply Div.)
Pulp—100 tpd defibrated
Hardboard—100 tpd

DULUTH, MINN.
(Duluth Mill)
Pulp—360 tpd defibrated
Hardboard—360 tpd

PHILLIPS, WIS.
(Lionite Hardboard Div.)
Pulp—defibrated
Hardboard, wallboard

Total production capacity:

PULP	
Defibrated	600 tpd

BUILDING BOARD	
Hardboard	600 tpd

Tembec/Midtec-Nitec

1155 Dorchester Blvd. W.
Montreal, Que. H3B 2H9
George S. Petty, chairman/chief executive officer

(These three companies are related under the overall umbrella of Repap Enterprises Inc. Repap is a majority owner of MN Holdings Inc., which owns 100% of Nitec and Midtec.)

Tembec: In 1981, the Temiscaming mill produced 145,588 metric tons of specialty sulfite pulps for market. Sales were C$95,697,000 and net income $4,317,000. A five-year capital spending program (1979-1983) is designed to modernize and expand capacity and improve recovery operations. In 1981 capital expenditures were $28,738,000, and $10,000,000 was budgeted for 1982.

Midtec and **Nitec:** Financial and production data are not available. In April 1982, the Nitec mill was shut down and the company filed for Chapter 11 protection, due primarily to a mixup over governmental funding for a U.S.$8,500,000 expansion program.

Production facilities:

NIAGARA FALLS, N.Y.
(Nitec Paper Corp.)
(Mill idle in mid-1982)
Pulp—80 tpd groundwood, 120 tpd deinked
Printing paper—230 tpd
Cellulose wadding & tissue—120 tpd

KIMBERLY, WIS.
(Midtec Paper Corp.)
Pulp—185 tpd groundwood
Coated printing, specialty paper—850 tpd

TEMISCAMING, QUE.
(Tembec Forest Products)
Pulp—500 metric sulfite paper and dissolving (for market)

Total production capacity:

PULP (short tons)		
Groundwood		265 tpd
Deinked		120 tpd
Sulfite		550 tpd
Total	935 tpd	

PAPER		
Printing paper		1080 tpd
Tissue		120 tpd
Total	1200 tpd	

Time Inc.

Time & Life Bldg.
New York, N.Y. 10020
Clinton G. Ames Jr., president/chief executive officer of Inland Container Corp.
Joe C. Denman Jr., president/chief executive officer of Temple-Eastex

(Temple-Eastex Inc. and Inland Container Corp. are wholly-owned subsidiaires of Time Inc.; Inland has 50% share in Georgia Kraft Co.)

Revenues from Time's Forest Products group in 1981 was $1,162,000,000—35% of corporate total.

Container/containerboard (Inland)	
Revenues:	
1981	$657,000,000
1980	579,000,000
Income:*	
1981	56,000,000
1980	53,000,000

Pulp/paperboard (Temple-Eastex)	
Revenues:	
1981	$295,000,000
1980	263,000,000
Income:*	
1981	48,000,000
1980	38,000,000

Building products (Temple-Eastex)	
Revenues:	
1981	$210,000,000
1980	193,000,000
Income:*	
1981	3,000,000
1980	−4,000,000

*Pretax operating income

Inland Container shipped 981,000 tons of corrugated boxes in 1981. Most of the linerboard is supplied by Georgia Kraft while Inland mills make the medium; including GK's output, Inland produced about 1,100,000 tons of containerboard in 1981.

At Temple-Eastex, 1981 production was 525,632 tons of paperboard and 525,632 tons of pulp.

Timberlands comprise 1,077,000 acres owned by Temple-Eastex, plus half the 1,100,000 acres owned and leased by Georgia Kraft.

Production facilities:

NEWARK, CALIF.
(Inland Container)
Recycled paperboard—150 tpd

KRANNERT and MACON, GA;
MAHRT, ALA.
(Georgia Kraft Co.)
Pulp—3600 tpd kraft (Inland's 50% is 1800 tpd)
Linerboard—4000 tpd (Inland's 50% is 2000 tpd)

NEWPORT, IND.
(Inland Container)
Recycled paperboard—150 tpd

NEW JOHNSONVILLE, TENN.
(Inland Container)
Pulp—400 tpd semichemical
Corrugating medium—500 tpd

DIBOLL, TEXAS
(Temple-Eastex, Building Products)
Pulp—500 tpd defibrated
Fiberboard—1,000,000 ft²/day

EVADALE, TEXAS
(Temple-Eastex, Pulp/Paperboard)
Pulp—1500 tpd kraft
Bleached board—1400 tpd

Total production capacity:

PULP	
Kraft	3300 tpd
Semichemical	500 tpd
Defibrated	500 tpd
Total	4300 tpd
PAPERBOARD	
Bleached board	3400 tpd
Corrugating medium	500 tpd
Recycled board	300 tpd
Total	4200 tpd
BUILDING BOARD	
Fiberboard	1,000,000 ft²/day

Union Camp Corp.

1600 Valley Rd.
Wayne, N.J. 07470
Peter J. McLaughlin, president/chief executive officer

Net sales:	
1981	$1,665,888,000
1980	1,574,825,000
Net earnings:	
1981	168,948,000
1980	165,132,000

Union Camp sales in 1981 rose 6% over 1980; income was up by 2%. Despite some market-related downtime, total paper product shipments of 2,160,000 tons were only 2% below the best-ever year, 1980. Shipments of unbleached paper/board were 656,654 tons, and of bleached paper/board 621,675 tons. Converted paper products shipments were 877,814 tons.

Capital spending to enhance productivity, increase output and lower costs has averaged $150,000,000/year for the past five years. Expenditures in 1982 will total $230,000,000. About one-third of this will go for a power plant project at Savannah and for the major program on UCC's agenda—the 600-tpd greenfield bleached pulp/paper mill being built near Eastover, S.C., targeted for late-1984 operation.

UCC has 1,700,000 acres of timberlands in six southeastern states.

Production facilities:

MONTGOMERY, ALA.
Pulp—2050 tpd kraft
Linerboard—2150 tpd

SAVANNAH, GA.
Pulp—2850 tpd kraft
Linerboard—1600 tpd
Unbleached paper—1500 tpd

MONROE, MICH.
Recycled paperboard—300 tpd

FRANKLIN, VA.
Pulp—2100 tpd kraft
Fine & industrial papers, board—1800 tpd

Total production capacity:

PULP	
Kraft	7000 tpd
PAPER & BOARD	
Unbleached paper	1500 tpd
Fine & industrial, paper/board	1800 tpd
Linerboard	3750 tpd
Recycled board	300 tpd
Total	7370 tpd

United States Gypsum Co.

101 S. Wacker Dr.
Chicago, Ill. 60606
Graham J. Morgan, chairman/chief executive officer

Hardboard and insulation board are included in U.S. Gypsum's wood-fiber and mineral-fiber products group, which accounted for 11% of corporate sales ($1,491,172,000) in 1981. The wood-fiber and mineral-fiber products posted increased operating profits in 1981 on a higher level of sales than in 1980.

Production facilities:

SOUTH GATE, CALIF.
Saturating felt, news & manila-lined chip—270 tpd

JACKSONVILLE, FLA.
Gypsum board liner—20 tpd

LISBON FALLS, MAINE
Insulation board—290,000 ft²/day (est. 100 tpd)

NORTH KANSAS CITY, MO.
Gypsum board liner—110 tpd

CLARK, N.J.
Gypsum board liner—270 tpd

OAKFIELD, N.Y.
Gypsum board liner—110 tpd

GYPSUM, OHIO
Gypsum board liner—110 tpd

PILOT ROCK, ORE.
Insulation board—150 tpd

OAKMONT, PA.
(Mill idle)
Kraft bag paper—60 tpd

GALENA PARK, TEXAS
Gypsum board liner—170 tpd

DANVILLE, VA.
Insulation board—500,000 ft²/day (est. 300 tpd)

Total production capacity:

PAPER & BOARD	
Gypsum board liner	970 tpd
Saturating felt, news & manila-lined chip	270 tpd
Total	1240 tpd
BUILDING BOARD	
Insulation board	580 tpd

Virginia Fibre Corp.

51 Locust Ave.
New Canaan, Conn. 06840
R.C. Macauley, president/chief executive officer

Financial data not available.

Production facilities:

RIVERVILLE, VA.
Pulp—510 tpd semichemical
Corrugating medium—600 tpd

Total production capacity:

PULP	510 tpd
PAPERBOARD	600 tpd

Wausau Paper Mills Co.

One Clark's Island, Box 1408
Wausau, Wis. 55401
Richard L. Radt, president/chief executive officer

Net sales:	
1981	$196,544,000
1980	163,718,000
Net earnings:	
1981	2,650,000
1980	6,720,000

(fiscal year ending Aug. 31)

In 1981, economic conditions coupled with major capital expenditures resulted in a drop in earnings. At the Brokaw mill, nearly $9,000,000 in capital expenditures were completed, adding 18,000 tpy to capacity. A machine rebuild was also completed at Hennepin, and product-mix programs initiated at Rhinelander.

At Brokaw, air emission problems have eluded conventional answers but a solution was ready for construction in early 1982. Capital expenditures for environmental control were $1,074,000 in 1981 and $4,000,000 was planned for 1982.

Wausau owns approximately 43,000 acres of timberland in Wisconsin.

Production facilities:

LITTLE FALLS, MINN.
(Hennepin Paper Co. Div.)
Pulp—60 tpd sulfite
Groundwood specialty paper—80 tpd

BROKAW, WIS.
(Brokaw Div.)
Pulp—190 tpd sulfite
Fine and specialty paper—375 tpd

RHINELANDER, WIS.
(Rhinelander Paper Co.)
Pulp—75 tpd sulfite, 15 tpd deinking
Glassine and greaseproof specialties—300 tpd

Total production capacity:

PULP		
Sulfite		265 tpd
Groundwood		60 tpd
Deinking		15 tpd
Total	340 tpd	
PAPER		
Groundwood specialties		80 tpd
Specialty paper grades		675 tpd
Total	775 tpd	

Western Forest Products Ltd.

1111 W. Georgia St.
Vancouver, B.C. V7E 3H1
J.L. Buttar, president

(Joint venture of B.C. Forest Products Ltd., Doman Industries Ltd. and Whonnock Industries Ltd., took over Rayonier mills in B.C. in 1980)

Financial data not available.

Capital spending in 1981 was C$27,000,000; with $7,000,000 to be expended in 1982 (limited to custodial-type spending to maintain reliability of operations). Expansion plans for both mills are indefinitely postponed.

Production facilities:

PORT ALICE, B.C.
Pulp—430 metric tpd sulfite dissolving (for market)

WOODFIBRE, B.C.
Pulp—475 metric tpd bleached kraft (for market)

Total production capacity:

PULP	905 metric tpd

Westvaco Corp.

299 Park Ave.
New York, N.Y. 10171
David L. Luke III, chairman

Net sales:	
1981	$1,550,529,000
1980	1,409,911,000
Net earnings:	
1981	100,791,000
1980	86,858,000

Westvaco sales for fiscal 1981 (ending October 31) were 10% above 1980. Earnings were up 16%. Pulp, paper/board and converted products comprise about 89% of Westvaco sales. Sales of bleached pulp, papers and paper products in 1981 were $920,253,000 and contributed $163,700,000 to operating profit. Sales of unbleached papers and paper products were $466,733,000 and provided $56,400,000 to operating profit.

Production of paper and paperboard in 1981 was 2,023,000 tons, and market pulp output was 105,100 tons.

Capital spending in 1981 was $147,905,000 and was expected to average approximately $180,000,000 in 1982.

A major five-year program focused on expanding primary papermaking capacity by 20% has been concluded. Planning for another five-year program is underway, with the expectation that capital expenditures will probably be at least $1,000,000,000 and may approach $1,500,000,000.

Westvaco owns 1,400,000 acres of forestland in South Atlantic and Midwest U.S. and Brazil.

Production facilities:

WICKLIFFE, KY.
(Fine Papers Div.)
Pulp—739 tpd bleached kraft
Fine papers—430 tpd

LUKE, MD.
(Fine Papers Div.)
Pulp—840 tpd kraft
Fine papers—1100 tpd

TYRONE, PA.
(Fine Papers Div.)
Fine papers—150 tpd

CHARLESTON, S.C.
(Kraft Div.)
Pulp—2455 tpd unbleached kraft
Paperboard—2250 tpd

COVINGTON, VA.
(Bleached Board Div.)
Pulp—1376 tpd kraft; 192 tpd semichemical
Paperboard—1313 tpd
Corrugating medium—312 tpd

Total production capacity:

PULP		
Kraft		5390 tpd
Semichemical		192 tpd
Total	5582 tpd	
PAPER & BOARD		
Fine papers		1680 tpd
Corrugating medium		312 tpd
Paperboard		3563 tpd
Total	5555 tpd	

Weyerhaeuser Co.

Tacoma, Wash. 98477
George H. Weyerhaeuser, president/chief executive officer

(Weyerhaeuser Canada Ltd. is a wholly-owned subsidiary; Weyco has 90% of North Pacific Paper Corp. joint venture)

Net sales:	
1981	$4,501,512,000
1980	4,535,814,000
Net earnings:	
1980	228,344,000*
1981	277,987,000*

*Extraordinary charges

Sales of pulp, paper/board and converted products account for 41% of Weyerhaeuser total in both 1981 and 1980.

Market pulp sales in 1981 were $460,000,000; paper was $314,000,000; paperboard $212,000,000; newsprint $155,000,000; converted products $727,000,000.

Production of market pulp in 1981 was 958,000 metric tons; 827,000 tons were shipped. Paper production was 470,000 short tons; 466,000 tons were shipped. Paperboard output was 1,803,000 tons; 559,000 tons were sold and 1,167,000 tons of containers and 53,000 tons of milk cartons were shipped. Newsprint production was 301,000 tons; 295,000 tons were shipped.

Capital spending in 1981 was $768,000,000, of which $295,000,000 was for bleached fiber products facilities and $137,000,000 for containerboard and containers. Spending in 1982 was expected to be significantly lower as major projects start up in the second half ($155,000,000 is committed for the Columbus mill, the Valliant expansion and a Structurwood facility in Michigan).

Weyerhaeuser owns more than 5,900,000 acres of commercial forestland.

Production facilities:

PINE BLUFF, ARK.
Pulp—300 tpd kraft
Sack paper—300 tpd

COLUMBUS, MISS. (started mid-1982)
Pulp—260 tpd thermomechanical
Lightweight coated paper—500 tpd

MONCURE, N.C.
Medium-density fiberboard—110 tpd

NEW BERN, N.C.
Pulp—800 tpd kraft (for market)

PLYMOUTH, N.C.
Pulp—1400 tpd kraft (some for market); 290 tpd semichemical
Containerboard—1375 tpd
Fine papers—800 tpd

BROKEN BOW, OKLA.
Pulp—500 tpd defibrated
Insulation board—400 tpd
Medium-density fiberboard—100 tpd

VALLIANT, OKLA.
Pulp—1500 tpd kraft; 500 tpd semichemical
Linerboard—1950 tpd (includes new 550-tpd machine, started mid-1982)
Corrugating medium—550 tpd

KLAMATH FALLS, ORE.
Pulp—150 tpd defibrated
Hardboard—150 tpd

NORTH BEND, ORE.
Pulp—300 tpd semichemical
Corrugating medium—400 tpd

SPRINGFIELD, ORE.
Pulp—1090 tpd kraft
Containerboard—1290 tpd

COSMOPOLIS, WASH.
Pulp—450 tpd sulfite (for market)

EVERETT, WASH.
Pulp—385 tpd kraft (for market)

LONGVIEW, WASH.
(Pulp & Paperboard Div.)
Pulp—750 tpd kraft (some for market); 200 tpd semichemical
Containerboard—270 tpd
Specialty paperboard—500 tpd

LONGVIEW, WASH.
(North Pacific Paper Co.)
Pulp—1440 tpd thermomechanical
Newsprint—1600 tpd

LONGVIEW, WASH.
(R-W Papers Div.)
Fine paper—200 tpd

ROTHSCHILD, WIS.
Pulp—210 tpd sulfite
Fine paper—240 tpd

KAMLOOPS, B.C.
(Weyerhaeuser Canada Ltd.)
Pulp—1135 metric tpd kraft (for market)

Total production capacity:

PULP	
Kraft	7475 tpd
Semichemical	1290 tpd
Sulfite	660 tpd
Thermomechanical	1700 tpd
Defibrated	650 tpd
Total	11,515 tpd

PAPER & BOARD	
Fine paper	1240 tpd
LWC paper	500 tpd
Sack paper	300 tpd
Specialty paperboard	500 tpd
Containerboard	5835 tpd
Newsprint	1600 tpd
Total	9975 tpd

BUILDING BOARD	
Insulation board, hardboard fiberboard	760 tpd

Willamette Industries Inc.

Western Kraft Paper Group
3700 First National Bank Tower
Portland, Ore. 97201
William Swindells Jr., president/chief executive officer

Net sales:	
1981	$975,640,000
1980	940,200,000
Net earnings:	
1981	28,604,000
1980	63,352,000

Pulp, paper/board and converted products accounted for about 68% of Willamette's total sales in 1981. Sales of pulp and paperboard were $166,337,000; of converted paper products $493,088,000.

Production at Willamette mills in 1981 was 815,425 tons of paper/board and 156,888 tons of pulp.

In late 1981, the new fine paper machine and supporting kraft pulp line started up at Hawesville. In first-half 1982, rebuilds increased containerboard capacity at the two West Coast mills.

Capital expenditures in 1981 were $134,761,000.

Willamette owns 557,000 acres of timberland in the West and South.

Production facilities:

PORT HUENEME, CALIF.
Corrugating medium—300 tpd

HAWESVILLE, KY.
(Kentucky Mills, Bleached Pulp)
Pulp—800 tpd bleached hardwood kraft (some for market)
Fine paper—285 tpd

HAWESVILLE, KY.
(Kentucky Mills, Corrugating Medium)
Pulp—300 tpd semichemical
Semichemical medium—330 tpd

CAMPTI, LA.
(Red River Mill Div.)
Pulp—750 tpd kraft
Kraft linerboard—850 tpd

ALBANY, ORE.
Pulp—650 tpd kraft, 200 tpd semichemical
Kraft liner & paper—800 tpd
Semichemical medium—250 tpd

Total production capacity:

PULP	
Kraft	2200 tpd
Semichemical	500 tpd
Total	2700 tpd

PAPER & BOARD	
Fine paper	285 tpd
Kraft paper & board	1650 tpd
Corrugating medium	880 tpd
Total	2815 tpd

COMPANY PROFILES
All-inclusive industry guide

A listing of all U.S. and Canadian pulp and paper firms; operations are grouped under corporate owner. Subsidiaries and joint ventures are cross-referenced. Production capacity data are shown in short tons for U.S. mills and indicated in metric tons for Canadian mills. Annual sales data (where available) are in U.S. dollars (unless indicated C$).

APL Corp.
1 Linden Place
Great Neck, N.Y. 11021
Harold L. Schwartz, chairman/chief executive officer

Sales (1980): $116,700,000

Production facilities:

FLAGSTAFF, ARIZ.
(Ponderosa Paper Products Inc.)
Pulp—50 tpd deinked
Paper—50 tpd tissue

PRYOR, OKLA.
(Robel Tissue Mills Inc.)
Pulp—125 tpd deinked
Paper—100 tpd tissue

ST. HELENS, ORE.
(Concel Inc., machine in Boise Cascade mill)
Paper—125 tpd tissue

Total production capacity:

Pulp	175 tpd deinked
Paper	275 tpd tissue

Abitibi-Price Inc.
SEE: "Major firms (1000 tpd)"

Acadia Forest Products Ltd.
Box 280
Nelson Miramichi, N.B. E0C 1T0
Joseph G. Kass, president/chief executive officer

Production facilities:

Pulp—Total 340 metric tpd groundwood (for market): 227 tpd bleached; 113 tpd unbleached

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Alabama River Pulp Co.
SEE: Parsons & Whittemore Inc. listing in "Major firms (1000 tpd)"

Alaska Lumber & Pulp Co. Inc.
(Sub. of Alaska America Inc.)
3000 Rainier Bank Tower
Seattle, Wash. 98104
Atusushi Nishizawa, president

Production facilities:

SITKA, ALASKA
Pulp—600 tpd dissolving sulfite (for market)

Allied Materials Corp.
Box 12340
Oklahoma City, Okla. 73157
T.D. Barbour, president

Production facilities:

STROUD, OKLA.
Paperboard—125 tpd roofing

Allied Paper Inc.
SEE: "Major firms (1000 tpd)"

Alpha Cellulose Corp.
1000 E. Noir St., Box 1305
Lumberton, N.C. 28358
J.E. Wilkinson, president

Production facilities:

Pulp—1000 tpd cotton linter specialty

Alton Packaging Corp.
SEE: "Major firms (1000 tpd)"

American Can Co.
American Lane
Greenwich, Conn. 06830
William S. Woodside, president/chief executive officer

Sales (1980): $4,810,000,000

American Can's papermaking facilities in U.S. have been divested; see James River Corp. listing in "Major firms (1000 tpd)" section.

Production facilities:

MARATHON, ONT.
(American Can Canada)
Pulp—450 metric tpd kraft (for market)

American Fibrit Inc.
76 Armstrong Rd., Box 1496
Battle Creek, Mich. 49016
Heinz Ebers, president

Production facilities:

Molded pulp

American Paper Products Co.
2113-31 E. Rush St.
Philadelphia, Pa. 19134
L.J. Perelman, president

Production facilities:

VINCENNES, IND.
(Vincennes Paper Mill Inc.)

Paperboard—70 tpd chipboard, kraft paper, newsboard

LANCASTER, PA.
Paperboard—50 tpd chipboard, newsboard, specialty board

Amricon Corp.
(Kerwin Paper Co., Div., formerly Riverside Paper Corp.)
800 S. Lawe St., Box 179
Appleton, Wis. 54912
Paul H. Groth, president/chief executive officer

Production facilities:

Pulp—60 tpd deinking
Paper—Total 100 tpd: 60 tpd fine papers, 40 tpd special industrial

Appleton Papers Inc.
SEE: "Major firms (1000 tpd)"

Arkansas Kraft Corp.
SEE: Green Bay listing in "Major firms (1000 tpd)"

Armstrong World Industries Inc.
(formerly Armstrong Cork Co.)
Liberty & Charlotte Sts., Box 3001
Lancaster, Pa. 17604
H.A. Jensen, president

Sales (1980): $1,322,967,000

Production facilities:

PENSACOLA, FLA.
Building board—Acoustical

MACON, GA.
Pulp—927 tpd defibrated
Building board—Acoustical, fiberboard, insulation, sheathing, wallboard

FULTON, N.Y.
Building board—Flooring felt, gaskets

Ashuelot Paper Co.
(Div. of Parker-Pace Corp.)
Hinsdale, N.H. 03451
Ian Smith, president

Production facilities:

Paper-40 tpd tissue, toweling

Atlantic Asbestos Corp.
Red Hook, N.Y. 12571
Harry Guiler, mill superintendent

Production facilities:
(Mill idle)
Paperboard--8 tpd asbestos, chipboard, bogus

Atlantic Packaging Products Ltd.
111 Progress Ave.
Scarsborough, Ont. M1P 2Y9
Phillip Granovsky, chairman

Production facilities:

Paperboard—270 metric tpd corrugating medium, linerboard

Austell Box Board Co.
Washington St., Box 157
Austell, Ga. 30001
James G. Dalton, chairman/president

Production facilities:

Paperboard—Total 355 tpd: 140 tpd linerboard, chipboard, newsboards; 215 tpd tube stock

BC Timber Ltd.
SEE: "Major firms (1000 tpd)"

B.J. Fibres
SEE: Ponderosa Fibres of America Group

Badger Paper Mills Inc.
W. Front St., Box 149
Peshtigo, Wis. 54157
E.A. Meyer Jr., chairman

Sales (1980): $35,000,000

Production facilities:

Pulp—150 tpd bleached sulfite
Paper—Total 140 tpd: 100 tpd fine papers, 40 tpd coarse papers

Baldwinville Products Inc.
SEE: Erving Paper Mills

Banner Fiberboard Co.
Box 390
Wellsburg, W. Va. 26070
F.L. Bush, president

Sales (1980): $3,000,000

Production facilities:

Paperboard—60 tpd tube stock, specialty boards, mill wrappers

Bato Co. Inc.
SEE: "Major firms (1000 tpd)"

Bear Brand Roofing Inc.
N. First St., Box 176
Bearden, Ark. 71720
L. Cross, president

Production facilities:

Building board—30 tpd roofing

Bear Island Paper Co.
SEE: Bato Co. Inc. listing in "Major firms (1000 tpd)"

Beckett Paper Co.
SEE: Hammermill Paper Co. listing in "Major firms (1000 tpd)"

Belkin Packaging Ltd.
Box 8930
Vancouver, B.C. V6B 4P5
Morris Belkin, president

Acquired two boxboard mills and three folding carton plants from Continental Group of Canada

Production facilities:

BURNABY, B.C.
(Belkin Paperboard)
Paper & board/building board—Total 500 metric tpd: 455 tpd boxboard, corrugating

medium, linerboard, roofing felts, gypsum board, building paper/board; 45 tpd special industrial papers

TORONTO, ONT.
Paperboard—300 metric tpd coated boxboard, linerboard

MONTREAL, QUE.
Paperboard—90 metric tpd backing, binders board, boxboard, can & core stock, chipboard

Total production capacity:

Paper	45 metric tpd
Paperboard	845 metric tpd

Belkin Paperboard
SEE: Belkin Packaging Ltd.

Beloit Box Board Co.
801 2nd St., Box 386
Beloit, Wis. 53511
John D. Fisher, president/treasurer

Sales (1980): $3,000,000

Production facilities:

Paperboard—45 tpd boxboard, chipboard, can & tube stock

Bemis Co. Inc.
800 Northstar Center
Minneapolis, Minn. 55402
Howard J. Curler, president/chief executive officer

Sales (1981): $719,008,000

Production facilities:

PEORIA, ILL.
Paper—Total 60 tpd: 45 tpd multiwall; 15 tpd flour bag stock

Bennett Ltd.
2700 Bourgogne St.
Chambly, Que. J3L 4B6
Ralph G. Fleet, president

Production facilities:

Paperboard—27 metric tpd binders board, packaging, wet machine boards, specialties

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Bergstrom Paper Co.
SEE: P.H. Glatfelter Co. listing in "Major firms (1000 tpd)"

Bermico Co.
2100 Northwestern Ave.
West Bend, Wis. 53095
Ted E. Gaty, president/chief executive officer

Production facilities:

Paperboard—50 tpd pipe conduit

Beveridge Paper Co.
SEE: Simkins Industries Inc.

Big Chief Roofing Co.
2300 P St. N.E.
Ardmore, Okla. 73401
C.W. Hogan, president

Production facilities:

Building board—50 tpd roofing

Bio-Tech
Battenville, N.Y.
(Rte 29, Greenwich, N.Y. 12834)
Marvin Ferris, president/general manager

Production facilities:

Paper—30 tpd tissue

Bird & Son Inc.
Washington Street
East Walpole, Mass. 02032
John A. Hixon, executive vice president, Building Materials Group

Sales (1981): $208,910,000

Production facilities:

SHREVEPORT, LA.
Roofing felt—235 tpd

PORTLAND, ORE.
Roofing felt—28 tpd

Total production capacity:

Roofing felt	263 tpd

Blandin Paper Co.
SEE: B.C. Forest Products Ltd. listing in "Major firms (1000 tpd)"

Boise Cascade Corp.
SEE: "Major firms (1000 tpd)"

Boise Southern Co.
SEE: Boise Cascade Corp. listing in "Major firms (1000 tpd)"

Bowater Inc.
SEE: "Major firms (1000 tpd)"

Brandywine Paper Corp.
131 Wallace Ave.
Downingtown, Pa. 19335
Morris Blank, president/treasurer

Production facilities:

Paper & board—100 tpd kraft paper, wrapping tissue, chipboard, fiberboard, specialties

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John Breakey Inc.
739 St. Augustin Ave.
Breakeyville, Que. G0S 1E0
J.M. Scott, president/general manager

Production facilities:

Pulp—60 metric tpd stone groundwood (for market)

British Columbia Forest Products Ltd.
SEE: BCFP and Mead Corp. listing in "Major firms (1000 tpd)"

Brown Products Inc.
One Pine St.
Nashua, N.H. 03060
Austin Barrett, chairman

Sales (1980): $5,000,000

Production facilities:

Paperboard—6 tpd corrugating medium

Brownville Paper Co.
SEE: Preco Corp.

Brunswick Pulp & Paper Co.
SEE: Mead Corp. and Scott Paper Co. listings in "Major firms (1000 tpd)"

Buckeye Cellulose Corp.
SEE: Procter & Gamble Co. listing in "Major firms (1000 tpd)"

Building Products of Canada Ltd.
(Sub of Imperial Oil Ltd.)
10500 Côte de Liesse
Lachine, Que. H8P 3E3
T.H. Cowtan, president

Production facilities:

EDMONTON, ALTA.
Building board—80 metric tpd gypsum linerboard, roofing felt

WABAMUN, ALTA.
Building board—40 metric tpd insulating board

WINNIPEG, MAN.
Building board—80 metric tpd roofing felt

LaSALLE, QUE.
Building board—100 metric tpd roofing felt, sheathing

PONT ROUGE, QUE.
Building board—180 metric tpd acoustical, asphalt, insulation board, roofing felt

Total production capacity:

Building board	480 metric tpd

Burrows Paper Corp.
501 E. Main St.
Little Falls, N.Y. 13365
Ralph W. Burrows, chairman/chief executive officer

Production facilities:

PICKENS, MISS.
(Burrows Southern Corp.)
Paper—20 tpd wrapping and specialty tissue

LITTLE FALLS, N.Y.
Paper—40 tpd carbonizing pattern, specialty tissue

LITTLE FALLS, N.Y.
(Mohawk Valley Paper Co.)
Paper—40 tpd pattern, specialty tissue

LYONSDALE, N.Y.
(Lyonsdale Div.)
Paper—40 tpd wrapping, napkins, specialty tissue

Total production capacity:

Paper	140 tpd

Burrows Southern Corp.
SEE: Burrows Paper Corp.

Byron Weston Co.
SEE: Crane & Co. Inc.

CIP Inc.
SEE: "Major firms (1000 tpd)"

CPM Inc.
131 Sullivan St.
Claremont, N.H. 03743
Harvey D. Hill, president

Production facilities:

CLAREMONT, N.H.
Paper—70 tpd special & industrial

EAST RYEGATE, VT.
(formerly Bemis Co. Inc.)
Paper—60 tpd special & industrial

Total production capacity:

Paper	130 tpd

California Paperboard Corp.
SEE: Newark Group Inc. listing in "Major firms (1000) tpd"

Canadian Cellulose Co. Ltd.
SEE: BC Timber listing in "Major firms (1000 tpd)"

Canadian Forest Products Ltd.
SEE: "Major firms (1000 tpd)"

Canadian Glassine Co. Ltd.
SEE: Deerfield Specialty Papers

Canadian International Paper Co.
SEE: CIP Inc. listing in "Major firms (1000 tpd)"

Canadian Keyes Fibre Co. Ltd.
SEE: Minas Basin Pulp & Power Ltd.

Cariboo Pulp & Paper Co.
SEE: Champion International listing in "Major firms (100 tpd)"

Carolina Paperboard Corp.
443 S. Gardner Ave.
Charlotte, N.C. 28208
W.B. Wood, vice president/general manager

Production facilities:

Paperboard—117 tpd chipboard, kraft paper, manila board

Carotell Paper Board Corp.
Alexander Dr., Box 655
Taylors, S.C. 29687
James F. Dalton, chairman

Production facilities:

Paperboard—150 tpd chipboard linerboard, specialties

Cascade Industries
SEE: Cascade Paper Inc.

Cascade Paper Inc.
404 Marie-Victorin St., Box 30
Kingsey Falls, Que. J0A 1B0
Bernard Lemaire, president

Production facilities:

CABANO, QUE.
(Papier Cascades (Cabano) Inc.)
Pulp—180 metric tpd semichemical
Paperboard—225 metric tpd corrugating medium

KINGSEY FALLS, QUE.
(Cascade Industries)
Paperboard—55 metric tpd corrugating medium, molded pulp, roofing

KINGSEY FALLS, QUE.
(Les Industries Cascades Ltee.)
Paper—40 metric tpd industrial, toweling tissue

KINGSEY FALLS, QUE.
(Papier Kingsey Falls Inc.)
Building board—145 metric tpd asbestos, asphalt, roofing

Total production capacity:

Pulp	180 metric tpd
Paper	40 metric tpd
Paperboard	425 metric tpd

Catawba Newsprint Co.
SEE: Bowater Inc. listing in "Major firms (1000 tpd)"

Cellu-Products Co.

Roby Martin & River Rds.
Patterson, N.C. 28661
Alan H. Miller, president

Production facilities:

EAST HARTFORD, CONN.
(Tissue Div.)
Paper—60 tpd tissue, toweling, wadding

PATTERSON, N.C.
Paper—35 tpd twisting tissue, wadding

PAXINOS, PA.
(Industrial Products Div.)
Paper—20 tpd wadding

Total production capacity:

Paper	115 tpd

Cellulo Co.

SEE: Filter Materials Inc.

Celotex Corp.

SEE: "Major firms (1000 tpd)"

Certain-Teed Corp.

750 E. Swedesford Rd.
Valley Forge, Pa. 19482
Gabriel Aufaure, president/chief executive officer

Sales: (1980) $868,227,000

Production facilities:

RICHMOND, CALIF.
Pulp—30 tpd defibrated
Building board—58 tpd roofing felt

SAVANNAH, GA.
Pulp—40 tpd defibrated
Building board—60 tpd roofing felt

EAST ST. LOUIS, ILL.
Pulp—90 tpd groundwood, defibrated
Building board—95 tpd roofing felt, sheathing

SHAKOPEE, MINN.
Pulp—80 tpd defibrated
Building board—150 tpd roofing felt

MILAN, OHIO
Pulp—Total 135 tpd: 90 tpd refiner mechanical; 45 tpd defibrated
Building board—90 tpd roofing felt

YORK, PA.
(Shelter Materials Group)
(Mill idle)
Pulp—60 tpd defibrated
Building board—85 tpd roofing felt

Total production capacity:

Pulp	435 tpd
Building board	558 tpd

Chagrin Fibers Inc.

Cleveland, Ohio

Purchased mill from Simplicity Pattern Co.

Production facilities:

NORFOLK, N.Y.
(Norfolk Div.)
Paper—50 tpd pattern, specialty tissue

Champion International Corp.

SEE: "Major firms (1000 tpd)"

Chase Bag Co.

2 Greenwich Plaza
Greenwich, Conn. 06830
F.H. Ludington Jr., chairman

Production facilities:

CHAGRIN FALLS, OHIO
(Paper Mill Div.)
Paper—62 tpd bag and sack, filter, toweling, specialties

Cheney Pulp & Paper Co.

Anderson St.
Franklin, Ohio 45005
E.H. Bindley, chairman

Production facilities:

Pulp—18 tpd linen, rag, jute, hemp

Chesapeake Corp. of Virginia

SEE: "Major firms (1000 tpd)"

Chesapeake Paperboard Co.

Fort Ave. & Woodall Sts.
Baltimore, Md. 21230
C.J. Smith, president

Production facilities:

Paperboard—250 tpd boxboard, chipboard

Cleaners Hanger Co.

670 17th St., N.W.
Massillon, Ohio 44646
R.W. Ruen, president

Production facilities:

Paperboard—70 tpd chipboard, containerboard

Clevepak Corp.

925 Westchester Ave.
White Plains, N.Y. 10604
H.J. McPherson, president/chief executive officer

Sales (1980): $107,593,000

Production facilities:

EATON, IND.
Paperboard—140 tpd chipboard

PIERMONT, N.Y.
Paperboard—185 tpd gypsum linerboard, shoeboard, tablet, tube stock

Total production capacity:

Paperboard	325 tpd

Climax Mfg. Co.

Climax St.
Castorland, N.Y. 13620
Charles S. Hirschey, chairman

Sales (1980): $30,000,000

Production facilities:

CARTHAGE, N.Y.
(Carthage Paper Makers Div.)
Paperboard—100 tpd boxboard, binders board, chipboard, foodboard, specialties

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Colonial Fiber Co.

SEE: Lydall Inc.

Columbia Corp.

Rt. 295
Chatham, N.Y. 12037
James L. Salerno, president/treasurer

Sales (1980): $16,500,000

Production facilities:

CHATHAM, N.Y.
Paperboard—90 tpd binders board, boxboard, chipboard, fiberboard, specialty

NORTH HOOSICK, N.Y.
Paperboard—100 tpd boxboard, specialty board

Total production capacity:

Paperboard	190 tpd

Concel Inc.
SEE: APL Corp.

Congoleum Corp.
(Resilient Flooring Div.)
195 Belgrove Dr.
Kearny, N.J. 07032
H.F. Pearson, president

Acquired by Fibic Inc. in 1980 (privately owned)

Production facilities:

FINKSBURG, MD.
Pulp—45 tpd mechanical
Building board—350 tpd flooring felt, roofing, sheathing

Connecticut Paperboard Corp.
SEE: Newark Group Inc. listing in "Major firms (1000 tpd)"

Connelly Containers Inc.
Righters Ferry Rd.
Bala Cynwyd, Pa. 19004
J. Donahue, president

Sales (1980): $49,527,000

Production facilities:

PHILADELPHIA, PA.
(Connelly Containers Inc. of Philadelphia)
Paperboard—125 tpd corrugating medium

Consolidated-Bathurst Inc.
SEE: "Major firms (1000 tpd)"

Consolidated Packaging Corp.
111 E. Wacker Dr.
Chicago, Ill. 60601
Joseph L. Gidwitz, chairman/chief executive officer

Sales (1980): $60,000,000

Production facilities:

FORT MADISON, IND.
Pulp—130 tpd semichemical
Paperboard—180 tpd corrugating medium

Consolidated Papers Inc.
SEE: "Major firms (1000 tpd)"

Container Corp. of America
SEE: "Major firms (1000 tpd)"

Continental Can of Canada
SEE: Continental Forest Industries listing in "Major firms (1000 tpd)"

Continental Fibre Co. Inc.
Front & Ford Sts.
Bridgeport, Pa. 19405
William Brennan, president

Production facilities:

Pulp—30 tpd rag
Paperboard—30 tpd for saturating vulcanized fiber

Continental Forest Industries
SEE: "Major firms (1000 tpd)"

Contoocook Valley Paper Co.
Box 528
West Henniker, N.H. 03242
Frederic H. Fletcher, president/treasurer

Production facilities:

Paperboard—20 tpd latex paper & board, shoeboard, specialties

Conwed Corp.
P.O. Box 43237
St. Paul, Minn. 55146
Frederick T. Weyerhaeuser, president

Sales (1980): $107,210,000

Production facilities:

CLOQUET, MINN.
Building board—300 million ft^2/yr mineral acoustical; 60 ESF/hr dry-felted wood blankets

RIVERSIDE, N.J.
Building board—75 tpd dry-felted wood blankets

Corning Fibers, Inc.
(Sub of PCI International)
Rte. 302, Box 647
Wells River, Vt. 05081
Maury Wallace, president

Production facilities:

Paper—10 tpd anti-tarnish, wrapping tissue

Cornwall Paper Mills Co.
51 S. Jefferson St.
Orange, N.J. 07050
Thomas G. San Giacomo, chief executive officer

Production facilities:

CORNWALL, N.Y.
Paperboard—180 tpd corrugating medium

Corrugated Services Inc.
On Interstate 20
Forney, Texas 75126
Jones Felvey, president

Production facilities:

Paperboard—100 tpd containerboard, impregnating, saturating

Cottrell Paper Co. Inc.
Rock City Falls, N.Y. 12863
J. Thomas Cottrell Jr., president

Sales (1980): $3,000,000

Production facilities:

FORT MILLER, N.Y.
(Fort Miller Div.)
Pulp—3 tpd rag

ROCK CITY FALLS, N.Y.
(Rock City Falls Mill)
Paperboard—6 tpd electrical insulating

Coy Paper Co.
Claremont, N.H. 03743
Hans Unander-Scharin, president

Production facilities:

Paper—19 tpd pattern, twisting tissue

Crane & Co. Inc.
30 South St.
Dalton, Mass. 01226
Bruce Crane, president

Sales (1980): $64,000,000

Production facilities:

DALTON, MASS.
(Bay State Mill)
Paper—20 tpd banknote, ~~bond~~, papeterie, wedding bristols & papers

DALTON, MASS.
(Byron Weston Co.)
Paper—45 tpd bond, bristols, business forms, fine paper, printing/writing, specialties

DALTON, MASS.
(Old Berkshire Mill)
Paper—3.5 tpd carbonizing tissue

DALTON, MASS.
(Pioneer Mill)
Paper—20 tpd fine papers: banknote, bond

DALTON, MASS.
(Wahconah Mill)
Paper—40 tpd printing & publication, banknote

Total production capacity:

Paper	128.5 tpd

Crestbrook Forest Industries Ltd.

(Pulp Div.)
(Sub. of Mitsubishi Corp. of Japan)
Box 4600
Cranbrook, B.C. V1C 4J7
Takeshi Morioka, chairman

Sales (1981): C$95,751,000

Production facilities:

SKOOKUMCHUCK, B.C.
Pulp—427 metric tpd kraft (for market)

Crocker Technical Papers Inc.

431 Westminster St.
Fitchburg, Mass. 01420
Richard P. Cuminale, chairman

Production facilities:

Paper—30 tpd capacitor, electrical insulating

Crown Paper Board Co. Inc.

Delaware Ave. & Tasker St.
Philadelphia, Pa. 19148
Jesse L. Salwen, president/general manager

Sales (1980): $14,000,000

Production facilities:

Paperboard—85 tpd boxboard, chipboard, specialty

Crown Simpson Co.

SEE: Crown Zellerbach and Simpson Paper Co. listings in "Major firms (1000) tpd"

Crown Zellerbach

SEE: "Major firms (1000 tpd)"

Crystal Tissue Co.

S. Verity Pkwy.
Middletown, Ohio 45042
Walter R. Bender, chairman

Sales (1980): $20,000,000

Production facilities:

Paper—50 tpd filter, specialty tissue

Davey Co.

164 Laidlaw Ave.
Jersey City, N.J. 07306
F.S. Madden, president/treasurer

Production facilities:

AURORA, ILL.
(Aurora Paperboard Div.)
Paperboard—100 tpd binders board, cover, fiberboard, mill boards

JERSEY CITY, N.J.
(Jersey City Mill)
Paperboard—100 tpd specialty board, binders board, mill boards, wet machine board

DOWNINGTOWN, PA.
Paperboard—70 tpd binders board, specialty board, wet machine board

Total production capacity:

Paperboard	270 tpd

Deerfield Specialty Papers

(Div of Reed Intl. Ltd. of U.K.)
45 William St.
Wellesley, Mass. 02181
N.W. Baldrachi, president

Production facilities:

AUGUSTA, GA.
Paper—35 tpd glassine

MONROE BRIDGE, MASS.
Paper—45 tpd glassine, greaseproof

QUEBEC CITY, QUE.
(Canadian Glassine Co. Ltd.)
Paper—27 metric tpd glassine, greaseproof, laminating, specialty

Total production capacity:

Paper	130 tpd

Delta Roofing Mills Inc.

(Sub. of Republic Gypsum)
646 Carnation St., Box 545
Slidell, La. 70458
L.E. Tinnel, president

Production facilities:

(Mill idle)
Building board—28 tpd roofing felt

Dexter Corp.

(C.H. Dexter Div.)
2 Elm St.
Windsor Locks, Conn. 06096
David L. Coffin, chairman/chief executive officer

Sales (1980): $534,991,000

Production facilities:

Pulp—60 tpd hemp
Paper—65 tpd capacitor, condenser, filter, specialty

Diamond International Corp.

SEE: "Major firms (1000 tpd)"

Doeskin Inc.

SEE: Statler Tissue Co.

Domtar Inc.

SEE: "Major firms (1000 tpd)"

Donohue Inc.

SEE: "Major firms (1000 tpd)"

Donohue St-Felicien Inc.

SEE: Donohue Inc. and B.C. Forest Products Ltd. listings in "Major firms (1000 tpd)"

Dunn Paper Co.

(Sub. of Dennison Mfg. Co.)
218 Riverview St.
Port Huron, Mich. 48060
R.E. Hubbard, president/chief executive officer

Production facilities:

PORT HURON, MICH.
Paper—125 tpd carbonizing, creping, laminating

WIGGINS, MISS.
Paper—45 tpd carbonizing, unbleached specialties

Total production capacity:

Paper—170 tpd

Durham Mill Inc.

(former mill of Whippany Paper Board)
Riegelsville, Pa. 18077
Lawrence Perkins, chairman

Production facilities:

Paperboard—400 tpd linerboard

EHV-Weidmann Industries Inc.

Box 278
Saint Johnsbury, Vt. 05819
Gordon P. Mills, president

Production facilities:

Paperboard—40 tpd electrical insulation

Eastern Fine Paper Inc.

SEE: Eddy Paper Co. Ltd. listing in "Major firms (1000 tpd)"

Eastman Kodak Co.

(Kodak Park Div.)
1669 Lake Avenue
Rochester, N.Y. 14650
Richard T. Kramer, vice president/general manager

Production facilities:

Paper—photographic base paper

Eaton-Dikeman

SEE: Knowlton Brothers Inc.

Eddy Paper Co. Ltd.

SEE: "Major firms (1000 tpd)"

Elk Corp.

(Sub of Elcor Corp.)
Box 37
Stephens, Ark. 71764
Roy E. Campbell, chairman

Sales (1980): $27,000,000

Production facilities:

Building board—95 tpd roofing felt

Equitable Bag Co. Inc.

45-50 Van Dam St.
Long Island City, N.Y. 11101
Leonard E. Canno, chairman/chief executive officer

Production facilities:

ORANGE, TEXAS
(Southern Div.)
Paper—87 tpd bag

Erving Paper Mills

Arch Street
Erving, Mass. 01344
Charles B. Housen, president

Production facilities:

BALDWINVILLE, MASS.
(Baldwinville Products Inc.)
Paper—120 tpd toweling

ERVING, MASS.
(Erving Mill)
Paper—110 tpd napkin tissue, toweling

HINSDALE, N.H.
(Hinsdale Products Co. Inc.)
Pulp—35 tpd deinking
Paper—Total 75 tpd: 25 tpd tissue, 50 tpd toweling

CINCINNATI, OHIO
Paper—Total 85 tpd: 65 tpd coarse; 20 tpd tissue

Total production capacity:

Pulp	35 tpd
Paper	390 tpd

Escanaba Paper Co.

SEE: Mead Corp. listing in "Major firms (1000 tpd)"

Esleeck Mfg. Co.

Canal St.
Turners Falls, Mass. 01376
William C. Blanker, president

Production facilities:

Pulp—rag
Paper—15 tpd thin, technical specialty, saturating-base papers

Eurocan Pulp & Paper Co. Ltd.

SEE: "Major firms (1000 tpd)"

Evans Products Co.

1121 S.W. Salmon St.
Portland, Ore. 97208
Monford A. Orloff, chairman/chief executive officer

Sales (1981): $1,537,157,000

Production facilities:

CORVALLIS, ORE.
(Forest-Fiber Products Group)
Pulp—120 tpd thermomechanical
Paper—15 tpd special industrial for battery separators
Building board—120 tpd hardboard

Exton Paper Manufacturers Inc.

Box 158, Meredith Rd.
Modena, Pa. 19358
Richard H. Darnell, executive vice president

Production facilities:

EXTON, PA.
Paper—20 tpd tissue, cellulose wadding

MODENA, PA.
(Valley Mill)
Paper—50 tpd kraft bag, wrapping

Total production capacity:

Paper	70 tpd

FSC Paper Corp.

SEE: Garden State Paper listing in "Major firms (1000 tpd)"

Federal Paper Board Co. Inc.

SEE: "Major firms (1000 tpd)"

Fiber Process Co.

SEE: Lydall Inc.

Fibre Form Corp.

722 S. Main Street
Columbia City, Ind. 46725
R. M. Brennan, president

Production facilities:

Molded pulp

Filter Materials Inc.

1401 Ware St., Box 329
Waupaca, Wis. 54981
John H. Gusmer, president/general manager

Sales (1980): $3,000,000

Production facilities:

FRESNO, CALIF.
(Gellulo Co.)
Paper & board—asbestos, filter, industrial

SANDUSKY, OHIO
(Cellulo Co.)
Paper & board—asbestos, filter, industrial

WAUPACA, WIS.
(Waupaca Mill)
Paper & board—10 tpd specialty board, felt, filter, saturating

Total production capacity:
Not available

Finch, Pruyn & Co.

1 Glen St.
Glen Falls, N.Y. 12801
Lyman A. Beeman Sr., chairman

Sales (1980): $110,000,000

Production facilities:

Pulp—380 tpd ammonium base bisulfite
Paper—575 tpd fine papers

Finlay Forest Industries Ltd.

(Sub. of Cattermole Timber Ltd. (42.7%), B.C. Forest Products Ltd. (42.7%) and Jujo Paper Co. Ltd. & Sumitomo Forestry Co. Ltd. of Japan (15%)
Box 250
Mackenzie, B.C. V0J 2C0
Ian Bell, president

Production facilities:

MACKENZIE, B.C.
Pulp—400 metric tpd bleached refiner groundwood (for market)

Fitchburg Paper Co.

SEE: Litton Industries Inc.

Five Star Paper Mills

SEE: Shur-Pak Industries Inc.

Flambeau Paper Co.

SEE: Pentair Inc. listing in "Major firms (1000 tpd)"

Fletcher Paper Co.

318 Fletcher St.
Alpena, Mich. 49707
Allan M. Fletcher, president

Sales (1980): $24,000,000

Production facilities:

Paper—75 tpd fine papers, coarse papers, printing/publication

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Flower City Tissue Mills Co.

700 Driving Park Ave.
Rochester, N.Y. 14613
W.F. Shafer Jr., president/chief executive officer

Sales (1980): $4,000,000

Production facilities:

Paper—12-20 tpd specialty and wrapping tissue

Fontana Paper Mills Inc.

SEE: Lunday-Thagard Oil Co.

J. Ford & Co. Ltd.

Portneuf, Que. G0A 2Y0
J.B. Ford, president

Production facilities:

Paper/board—Total 160 metric tpd: 90 tpd kraft board, tape, creping tissue, specialties; 70 tpd roofing felt

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Forest Fiber Products Co.

(Div. of Stimson Lumber C[illegible]
Box 68
Forest Grove, Ore. 97116
Darrell Schroader, president

Production facilities:

Pulp—140 tpd groundwood
Building board—140 tpd hardboard

Fort Howard Paper Co.

SEE: "Major firms (1000 tpd)"

Fort Orange Paper Co. Inc.

1900 River Rd.
Castleton-on-Hudson, N.Y. 12033
David Little, president

Production facilities:

Paperboard—110 tpd folding boxboard

Foster Paper Co. Inc.

2160 Erie St.
Utica, N.Y. 13503
Martin P. Forte Sr., president/general manager

Production facilities:

Paperboard—75 tpd bristols, can stock, foodboard, shoeboard, specialties

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Fox Paper Inc.

SEE: Erving Paper Mills

Fox River Paper Co.

(Div. of Fox Valley Corp.)
401 S. Appleton St.
Appleton, Wis. 54913
Harold L. Ellsworth, president

Production facilities:

Paper—85 tpd fine papers, printing/writing, technical, specialty

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Fraser Inc.

SEE: Fraser and also Noranda Mines Ltd. listings in "Major firms (1000 tpd)"

French Paper Co.

Box 729
Niles, Mich. 49120
J. E. French, chairman/chief executive officer

Production facilities:

Paper—60 tpd fine papers, greeting card, specialty

GAF Corp.

SEE: "Major firms (1000 tpd)"

Garden State Paper Co. Inc.

SEE: "Major firms (1000 tpd)"

Gaspesia Pulp & Paper Co.

SEE: Abitibi-Price Inc. listing in "Major firms (1000 tpd)"

Genstar Building Materials Co.

(formerly Flintkote Co., acquired by Genstar in early 1980)
580 Decker St.
Irving, Texas 75062

James D. Moran, chairman/chief executive officer

Production facilities:

LITTLE ROCK, ARK.
Building board—40 tpd roofing felt

VERNON, CALIF.
(Pioneer Bldg. Products)
Pulp—30 tpd defibrated
Building board—Total 365 tpd: 180 tpd gypsum linerboard, 185 tpd roofing felt

MT. CARMEL, ILL.
(Mill idle)
Pulp—75 tpd TMP, defibrated
Building board—100 tpd roofing felt

JERSEY CITY, N.J.
(Mill idle)
Building board—75 tpd roofing felt

CORNELL, WIS.
Pulp—60 tpd defibrated
Building board—220 tpd roofing

Total production capacity:

Pulp	165 tpd
Building board	800 tpd

S. George Co.
125 Eleventh St.
Wellsburg, W. Va. 26070
Wylie B. Mendel, president

Production facilities:
(Mill idle)
Paper—10 tpd kraft

Georgia-Bonded Fibers Inc.
Rte. 60
Buena Vista, Va. 24416
Hugo N. Surmonte, chairman

Sales (1981) $25,000,000

Production facilities:

Paperboard—40 tpd automobile board, backing, gasket, innersole, etc.

Georgia Kraft Co.
SEE: Mead Corp. and Time Inc. listings in "Major firms (1000 tpd)"

Georgia-Pacific Corp.
SEE: "Major firms (1000 tpd)"

Gilbert Paper Co.
SEE: Mead Corp. listing in "Major firms (1000 tpd)"

Gilman Paper Co.
SEE: "Major firms (1000 tpd)"

P.H. Glatfelter Co.
SEE: "Major firms (1000 tpd)"

Goodson's Manufacturing Corp.
1400 Coastal St.
Blountstown, Fla. 32424
Howard Goodson, president

Production facilities:

Pulp—210 tpd defibrated
Building board—525,000 ft^2/day insulation board, sheathing

W. R. Grace & Co.
(Polyfibron Div.)
Rte. 60 E.
Owensboro, Ky. 42301
L.K. Martin, plant manager

Production facilities:

Paper—35 tpd absorbent, cover, gasket, leather substitute, saturating, specialty

Grays Harbor Paper Co.
SEE: ITT Rayonier Inc. & Hammermill Paper Co. listings in "Major firms (1000) tpd"

Great Lakes Forest Prods. Ltd.
SEE: "Major firms (1000 tpd)"

Great Northern Nekoosa Corp.
SEE: "Major firms (1000 tpd)"

Great Northern Paper
SEE: Great Northern Nekoosa Corp. listing in "Major firms (1000 tpd)"

Great Southern Paper
SEE: Great Northern Nekoosa Corp. listing in "Major firms (1000 tpd)"

Green Bay Packaging Inc.
SEE: "Major firms (1000 tpd)"

Grief Board Corp.
(Sub. of Grief Bros. Corp.)
9420 Warmington St. S.W., Box 553
Massillon, Ohio 44646
William R. Shew, president

Production facilities:

Paperboard—175 tpd chipboard, linerboard

Groveton Papers Co.
SEE: Diamond International Corp. listing in "Major firms (1000 tpd)"

Gulf States Paper Corp.
SEE: "Major firms (1000 tpd)"

Halifax Paper Board Co.
Roanoke Ave., Box 368
Roanoke Rapids, N.C. 27870
Robert S. McCabe, president

Production facilities:

Paperboard—80 tpd chipboard, laminating, newsboard, etc.

Halltown Paperboard
Box 110
Halltown, W. Va. 25423
C. C. Hammann, president

Production facilities:

Paperboard—180 tpd boxboard, automobile, chipboard, specialty

Halsey Pulp Co.
SEE: James River Corp. listing in "Major firms (1000 tpd)"

Hammermill Paper Co.
SEE: "Major firms (1000 tpd)"

Harding-Jones Paper Co.
Box 40
Middletown, Ohio 45042
H. Harding Jones, chairman

Sales (1980): $3,000,000

Production facilities:

Paper—22 tpd rag paper

Harriman Paperboard Corp.
SEE: Lawrence Paperboard Corp.

Haverhill Paperboard Co.
SEE: Newark Group Inc. listing in "Major firms (1000 tpd)"

Hawthorne Paper Co. Inc.
(Sub. of Gould Paper Corp.)
145 E. 32nd St.
New York, N.Y. 10016

Production facilities:

KALAMAZOO, MICH.
(Mill idle)
Paper—50 tpd fine papers

Hennepin Paper Co.
SEE: Wausau Paper Mills Co. listing in "Major firms (1000 tpd)"

Henry Molded Products Inc.
71 N. 16th St., Box 75
Lebanon, Pa. 17042
Douglass C. Henry, president/treasurer

Production facilities:

Molded pulp—15 tpd

Hercules Inc.
910 Market St.
Wilmington, Del. 19899
W. M. Bromm, plant manager

Sales (1980): $2,480,000,000

Production facilities:

HOPEWELL, VA.
(Water Soluble Polymers)
Pulp—Total 250 tpd: 150 tpd sheeted chemical cotton; 100 tpd loose chemical cotton

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Hinsdale Products Co. Inc.
SEE: Erving Paper Mills

Hoague Sprague Corp.
(Boxboard Div.)
West Hopkinton, N.H. 03283
Richard L. Knapton, general manager

Production facilities:

Paperboard—75 tpd boxboard, chipboard, newsboard

Hollingsworth & Vose Co.
112 Washington St.
East Walpole, Mass. 02032
Mark Hollingsworth, president

Production facilities:

EAST WALPOLE, MASS.
(East Walpole Mill)
Paper—50 tpd creping, insulating, filter, specialties

WEST GROTON, MASS.
Paper—50 tpd special industrial

EASTON, N.Y.
(Hovotex Div., Eastern Mill)
Paper—35 tpd special industrial

GREENWICH, N.Y.
(Blandy Paper Div.)
Paper—12 tpd filter, impregnating

GREENWICH, N.Y.
(Easton Mill)
Paper—30 tpd filter, impregnating

Total production capacity:

Paper	177

Homasote Co.
Box 7240
Trenton, N.J. 08628
Irving Flicker, chairman

Sales (1980): $18,766,060

Production facilities:

Paperboard/building board—325 tpd wallboard, building paper/board, fiberboard, insulation, shoeboard

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Howard Paper Mills Inc.
115 Columbia St.
Dayton, Ohio 45407
Ward Harrison, chairman

Sales (1980): $100,000,000

Production facilities:

WATERVLIET, MICH.
(Watervliet Paper Co.)
Paper—125 tpd printing & specialty papers, coated, label, playing card

DAYTON, OHIO
Paper—125 tpd fine papers, business forms, copy, specialties

URBANA, OHIO
Paper—80 tpd fine papers, bond, business form, copy, specialties

Total production capacity:

Paper	330 tpd

Huebert Fiberboard Inc.
Box 167, E. Morgan St.
Boonville, Mo. 65233
J. Huebert, president/production manager

Production facilities:

Pulp—60 tpd defibrated
Building board—70 tpd fiberboard, insulation board, sheathing

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IKO Industries Ltd.
1600 42nd Ave. S.E.
Calgary, Alta. T2P 2L2
Harry Koschitzky, president

Production facilities:

CALGARY, ALTA.
Building board—45 metric tpd building paper/board, roofing felt, saturating

BRAMPTON, ONT.
Pulp—90 metric tpd defibrated
Building board—100 metric tpd building paper/board, roofing felt, saturating

Total production capacity:

Pulp	90 metric tpd
Building board	145 metric tpd

ITT Rayonier Inc.
SEE: "Major firms (1000 tpd)"

Imperial Paper Co.
(Sub. of Collins & Aikman)
23645 Mercantile Rd.
Cleveland, Ohio 44122
William D. Armstrong, president

Production facilities:

PLATTSBURGH, N.Y.
Paper—40 tpd coating base, groundwood specialties, specialty

Inland Container Corp.
SEE: Time Inc. listing in "Major firms (1000 tpd)"

Inland Empire Co.

3320 N. Argonne
Spokane, Wash. 99206
Wm. B. Hyde, chairman

Production facilities:

Pulp—120 tpd refiner mechanical
Paper—160 tpd newsprint

Intercontinental Pulp Co.

SEE: Canadian Forest Products Ltd. listing in "Major firms (1000 tpd)"

International Paper Co.

SEE: "Major firms (1000 tpd)"

Interstate Container Corp.

SEE: "Major firms (1000 tpd)"

Interstate Folding Box Co.

(Div. of American Bag & Paper Co.)
300 Verity Parkway
Middletown, Ohio 45042
Steven B. Schottland, division manager

Production facilities:

MIAMISBURG, OHIO
(Miamisburg Boxboard Div.)
Paperboard—100 tpd specialty board

Interstate Intercorr Corp.

SEE: Interstate Container Corp. listing in "Major firms (1000 tpd)"

Irving Forest Products

SEE: "Major firms (1000 tpd)"

James River Corp. of Virginia

SEE: "Major firms (1000 tpd)"

Jenkins Products Corp.

120 High St.
Bridgewater, Mass. 02324
Timothy H. Brooks, president

Production facilities:

Paperboard—20 tpd automobile board, chipboard, gasket, pasted board

Johns-Manville Corp.

SEE: Manville Corp. listing in "Major firms (1000 tpd)"

Keiding Inc.

4545 W. Woolworth Ave.
Milwaukee, Wis. 53218
Donald C. Bohlmann, president

Production facilities:

Molded pulp

Keyes Molded Container Group

(Div. of Royal Packaging Industries Van Leer B.V., based in Amstelveen, Holland)

Production facilities:

ALBERTVILLE, ALA.
Molded pulp

SACRAMENTO, CALIF.
Molded pulp—124 tpd

HAMMOND, IND.
Molded pulp

SHAWMUT, MAINE
Pulp—120 tpd bleached groundwood

WATERVILLE, MAINE
Molded pulp

WENATCHEE, WASH.
Molded pulp—30 tpd

Kieffer Paper Mills Inc.

1220 W. Spring
Brownstown, Ind. 47220
Kieran M. Devery Jr., president

Production facilities:

Paper & board—130 tpd bogus: corrugating medium, creping paper, imprégnating, industrial, specialty

Kimberly-Clark Corp.

SEE: "Major firms (1000 tpd)"

Kingsey Falls Paper Inc.

SEE: Cascade Paper Inc.

Knowlton Brothers Inc.

105 W. 45th St.
Chattanooga, Tenn. 37410
David Knowlton, chairman

Production facilities:

MADISONVILLE, KY.
(Southern Specialty Div.)
Paper—40 tpd special industrial, filter

WATERTOWN, N.Y.
(Watertown Mill)
Paper—20 tpd special industrial: filter, photographic base

MOUNT HOLLY SPRINGS, PA.
(Eaton-Dikeman Div.)
Paper—12 tpd special industrial: filter, specialty

CHATTANOOGA, TENN.
(Southern Cellulose Products)
Pulp—85 tpd cotton linter (for market)

CHATTANOOGA, TENN.
(Southern Specialty Div.)
Paper—15 tpd special industrial: blotting, coating base, filter

Total production capacity:

Pulp	85 tpd
Paper	87 tpd

Koppers Co. Inc.

940 River Rd.
North Tonawanda, N.Y. 14120
F. Killion, plant manager

Production facilities:

Building board—50 tpd roofing felt

Kruger Inc.

SEE: "Major firms (1000 tpd)"

Lake Utopia Paper Ltd.

SEE: Irving Forest Products Inc. listing in "Major firms (1000 tpd)"

Lawrence Paperboard Corp.

250 Canal St.
Lawrence, Mass. 01842
J.D. Caimi, president

Production facilities:

LAWRENCE, MASS.
Paperboard—200 tpd recycled clay-coated cylinder board

HARRIMAN, TENN.
(Harriman Paperboard Corp.)
Pulp—185 tpd semichemical
Paperboard—190 tpd corrugating medium

Total production capacity:

Pulp	185 tpd
Paperboard	390 tpd

Leatherback Industries Inc.
(Sub. of Hollinee Corp.)
111 Hillcrest Rd., Box 594
Hollister, Calif. 95023
E.A. DiSalvo, president

Production facilities:

HOLLISTER, CALIF.
Building board—55 tpd roofing felt

ALBUQUERQUE, N.M.
Building board—18 tpd roofing felt

Total production capacity:

Building board	73 tpd

Leggett & Platt Inc.
18th Rd., Box 757
Carthage, Mo. 64836
Harry M. Cornell Jr., president/chief executive officer

Sales (1980): $229,190,000

Production facilities:

MAXTON, N.C.
(Packaging Div.)
Paper—35 tpd wadding

Les Industries Cascades Ltee.
SEE: Cascade Paper Inc.

Lincoln Paper Mills Inc.
300 Bergen Turnpike
Ridgefield Park, N.J. 07660
R. Werner, president

Production facilities:

Paperboard—125 tpd

Lincoln Pulp & Paper Co. Inc.
SEE: Preco Corp.

Linweave Inc.
10 Linweave Dr.
Holyoke, Mass. 01040
Robert H. Belsky, president

Production facilities:

Paper—100 tpd fine papers: bristols, greeting card, offset, papeterie, writing

Lionite Hardboard
SEE: Superwood Corp. listing in "Major firms (1000 tpd)"

Little Rapids Corp.
Box 3629, 2273 Larsen Rd.
Green Bay, Wis. 54303
Richard D. Egan, president

Production facilities:

SHAWANO, WIS.
(Shawano Paper Mills)
Paper—160 tpd special industrial papers and tissue

Litton Industries Inc.
360 N. Crescent Dr.
Beverly Hills, Calif. 90210

Sales (1980): $4,250,000,000

Production facilities:

LOCKPORT, LA.
(Valentine Pulp & Paper Co.)
Thomas D. Robichaux, general manager
Pulp—115 tpd bagasse
Paper—150 tpd fine paper, printing/writing

FITCHBURG, MASS.
(Fitchburg Paper Co.)
Eugene L. Sorbo, president
Paper—225 tpd book, fine paper, kraft paper, papeterie, reprographic, specialty, technical

Total production capacity:

Pulp	115 tpd
Paper	375 tpd

Lockport Paperboard Corp.
Mill & Olcott Sts.
Lockport, N.Y. 14094
R.J. Hahn, president

Production facilities:

(Mill idle)
Paperboard—85 tpd boxboard, gypsum linerboard, jute board, other specialty

Longview Fibre Co.
SEE: "Major firms (1000 tpd)"

Los Angeles Paper Box & Board Mills
5959 E. Randolph St.
Los Angeles, Calif. 90022
Wm. H. Kewell Jr., president/secretary/treasurer

Production facilities:

Paperboard—75 tpd boxboard, chipboard

Louisiana-Pacific Corp.
SEE: "Major firms (1000 tpd)"

Lowe Paper Co.
River St.
Ridgefield, N.J. 07657
D. McBride Jr., chairman

Production facilities:

Paperboard—140 tpd boxboard

Lunday-Thagard Oil Co.
9301 S. Garfield Ave.
South Gate, Calif. 90280
George Thagard Jr., president

Production facilities:

FONTANA, CALIF.
(Fontana Paper Mills Inc.)
Building board—35 tpd roofing felt

SOUTH GATE, CALIF.
(Lunday-Thagard Roofing Co.)
Building board—35 tpd

Total production capacity:

Building board	70 tpd

Lydall Inc.
1 Colonial Rd.
Manchester, Conn. 06040
Millard H. Pryor Jr., president

Sales (1980): $97,721,000

Production facilities:

MANCHESTER, CONN.
(Colonial Fiber Co.)
Paperboard—36 tpd automobile, fiberboard, shoeboard

MANCHESTER, CONN.
(Lydall & Foulds)
Paperboard—85 tpd chipboard, newsboard, specialty

BAR MILLS, MAINE
(Mill idle)
(Colonial Fiber Div., Rogers Plant)
Paperboard—16 tpd fiberboard, gasket, shoeboard

ROCHESTER, N.H.
(Fiber Process Co.)
Paper—10 tpd asbestos, creping, filter, specialty

HOOSICK FALLS, N.Y.
(Colonial Fiber Div., Hoosick Falls Oper.)
Paperboard—15 tpd automobile, binders, insulating, hardboard, specialty

COVINGTON, TENN.
(Colonial Fiber Div., Covington Plant)
Paper & board—60 tpd insulating, fiberboard, shoeboard, trunk, automobile

Total production capacity:

Paper & board	222 tpd

James Maclaren Co. Ltd.

SEE: Noranda Mines Ltd. listing in "Major firms (1000 tpd)"

MacMillan Bloedel Ltd.

SEE: "Major firms (1000 tpd)"

Madison Paper Corp.

(Owned 60% by Myllykoski of Finland, 40% by New York Times Co.)
Box 129
Madison, Maine 04950
C.R. Recor, chairman

Production facilities:

Pulp—380 tpd groundwood
Paper—520 tpd printing & publication, uncoated

Herbert Malarkey Roofing Co.

(Paper Div.)
3131 N. Columbia Blvd.
Portland, Ore. 97217
Michael O. Malarkey, president/resident manager

Production facilities:

Pulp—40 tpd groundwood
Building board—40 tpd building paper/board, roofing, saturating

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Manchester Board & Paper Co.

111 Hull St.
Richmond, Va. 23224
Kenneth Aspinall, president

Production facilities:

Paperboard—100 tpd boxboard, chipboard, manila,

Manistique Papers Inc.

Box 111
Manistique, Mich. 49854
Leif Christensen, vice president/general manager

Production facilities:

Pulp—Total 165 tpd: 90 tpd groundwood; 75 tpd deinked
Paper—200 tpd newsprint, groundwood specialties

Manitoba Forestry Resources Ltd.

902-213 Notre Dame Ave.
Winnipeg, Man. R3B 1N3
L.J. Hallgrimson, president/chairman

Production facilities:

THE PAS, MAN.
Pulp—360 metric tpd unbleached kraft (some for market)
Paper—340 metric tpd extensible, multiwall bag

Manning Paper Co.

SEE: Hammermill Paper Co. listing in "Major firms (1000 tpd)"

Manville Corp.

SEE: "Major firms (1000 tpd)"

Marcal Paper Mills Inc.

1 Market St.
Elmwood Park, N.J. 07407
R. L. Marcalus, president

Production facilities:

MECHANIC FALLS, MAINE
Paper—75 tpd tissue, toweling, wadding

BLOOMFIELD, N.J.
(Mill idle)
Paper—20 tpd tissue, toweling

ELMWOOD PARK, N.J.
(Elmwood Park Mill)
(Mill idle)
Paper—80 tpd tissue

Total production capacity:

Paper	175 tpd

Marlboro Mfg. Ltd.

191 St. Henri St., Box 366
Drummondville, Que. J2B 6W3

Production facilities:

Paper—15 metric tpd toilet tissue

Martisco Paper Co. Inc.

4747 Route 174
Marcellus, N.Y. 13108
Frank Fernandez, president

Production facilities:

Paperboard—15 tpd bogus

Maryland Paper Box Co.

4545 Old Annapolis Rd.
Baltimore, Md. 21227
Samuel A. Melton, plant manager

Production facilities:

WHITE HALL, MD.
(Reading-White Hall Paper Board Co.)
Paperboard—40 tpd chipboard, boxboard

READING, PA.
Paperboard—35 tpd chipboard, boxboard

Total production capacity:

Paperboard	75 tpd

Masonite Corp.

SEE: "Major firms (1000 tpd)"

McIntyre Bros. Paper Co. Inc.

131 Mill St.
Fayetteville, N.Y. 13066
W.E. McIntyre Sr., president

Production facilities:

Paper & board: 15 tpd kraft, lightweight wrapping

Mead Corp.

SEE: "Major firms (1000 tpd)"

Menasha Corp.

Box 367
Neenah, Wis. 54956
D.C. Shepard, chief executive officer

Production facilities:

OTSEGO, MICH.
Pulp—300 tpd semichemical
Semichemical board—375 tpd

MENASHA, WIS.
(Menasha Paperboard Mill)
Combination (recycled) board—175 tpd

Total production capacity:

Pulp	300 tpd
Paperboard	550 tpd

Menominee Paper Co. Inc.

(Sub. of Bell Fibre Products Corp.)
144 First St.
Menominee, Mich. 49858
Donald Estebo, general manager

Production facilities:

Paper & board—Total 400 tpd: 50 tpd fine papers; 350 tpd paperboard

Merrimac Paper Co. Inc.

9 S. Canal St.
Lawrence, Mass. 01842
Robert J. Van Nostrand, chairman/chief executive officer

Sales (1980): $20,000,000

Production facilities:

Paper—85 tpd special industrial, absorbent, bristols, cover, creping, insulating, technical

Miami Paper Corp.

SEE: Pentair Inc. listing in "Major firms (1000 tpd)"

Middletown Paperboard Co.

SEE: Newark Group Inc. listing in "Major firms (1000 tpd)"

Midtec Paper Corp.

SEE: Tembec Forest Products Inc. listing in "Major firms (1000 tpd)"

Millen Industries Inc.

444 Park Ave. South
New York, N.Y. 10022
Milton M. Schulman, president

Production facilities:

GARWOOD, N.J.
(Garwood Paper Div.)
Paperboard—120 tpd boxboard, chipboard, core & tube stock, wallboard

Millers Falls Paper Co.

(An EG&G Co.)
Millers Falls, Mass. 01349
Charles S. Sweitzer, president/general manager

Production facilities:

Paper—26 tpd fine papers, technical papers

Milton Leather Board Co.

Milton, N.H. 03851

Production facilities:
(Mill idle)
Paperboard—10 tpd shoeboard

Minas Basin Pulp & Power Co. Ltd.

Prince Street
Hantsport, N.S. B0P 1P0
J.J. Jodrey, president/chairman

Production facilities:

HANTSPORT, N.S.
Pulp—36 metric tpd groundwood
Paperboard—90 metric tpd chipboard, containerboard, boxboard, manila board

HANTSPORT, N.S.
(Canadian Keyes Fibre Co. Ltd.)
Molded pulp

Mohawk Paper Mills Inc.

465 Saratoga St.
Cohoes, N.Y. 12047
Thomas D. O'Connor, president/chairman

Production facilities:

COHOES, N.Y.
(Cohoes Mill)
Paper—70 tpd textbook, bristols, specialty, technical

WATERFORD, N.Y.
Paper—70 tpd fine papers: bond, book, bristols, card, drawing, other specialties

Total production capacity:

Paper	140 tpd

Mohawk Pulp Co. Ltd.

Box 542
Rivière-du-Loup, Que. G5R 3Z1
J. L. Marquis, general manager

Production facilities:

CHEMIN DU LAC, QUE.
Pulp—45 metric tpd unbleached stone groundwood (for market)

RIVIÈRE-DU-LOUP, QUE.
Pulp—35 metric tpd refiner mechanical (for market)

Total production capacity:

Pulp	80 metric tpd

Mohawk Valley Paper Co.

SEE: Burrows Paper Corp.

Monadnock Paper Mills Inc.

Antrim Rd.
Bennington, N.H. 03442
Richard G. Verney, president

Production facilities:

Paper—75 tpd art, book, cotton fiber, cover, industrial, technical

Morris Paper Board Co.

(Div. Berles Carton)
177 Third Ave.
Paterson, N.J. 07509
B. Lesenger, president

Production facilities:

Paperboard—110 tpd boxboard, chipboard, kraft paper, newsboard

Mosinee Paper Corp.

(Pulp & Paper Div.)
Mosinee, Wis. 54455
C. Scholtens, chairman/president/chief executive officer

Sales (1981): $90,876,000

Production facilities:

Pulp—195 tpd semibleached kraft
Paper—250 tpd kraft, MG and MF papers

Mountain Paper Products Corp.

Box 271
Bellows Falls, Vt. 05101
Daniel Sudarsky, president

Production facilities:

Paper—22 tpd album, bogus, braille, coating base, drawing, manila

NVF Co.
1 Yorklyn Rd.
Yorklyn, Del. 19736
V. Posner, president/chairman

Sales (1980): $885,930,000

Production facilities:

NEWARK, DEL.
Paper—16 tpd for vulcanized fiber

YORKLYN, DEL.
(Marshall Bros. Mill)
(Mill idle)
Paper—14 tpd for vulcanized fiber

YORKLYN, DEL.
(Yorklin Mill)
Paper & board—20 tpd insulation board, trunk board, vulcanized fiber

HOLYOKE, MASS.
(Parsons Paper)
Paper—25 tpd fine papers: art, cotton fiber, impregnating, onionskin, technical

Total production capacity:

Paper	75 tpd

Nabisco Inc.
River Rd. & DeForest Ave.
East Hanover, N.J. 07936
Robert M. Schaeberle, chairman

Production facilities:

Paperboard—250 tpd cracker shell, folding boxboard, machine coated

Natick Paperboard Co.
SEE: Newark Group Inc. listing in "Major firms (1000 tpd)"

National Fibrit
(Div. of Mansfield Tire & Rubber)
Box 609
Springfield, Tenn. 37172
Leo Fuchs, general manager

Production facilities:
(Mill idle)
Pulp—75 tpd thermomechanical
Molded pulp

National Gypsum Co.
SEE: "Major firms (1000 tpd)"

Neenah Paper Co.
SEE: Kimberly-Clark Corp. listing in "Major firms (1000 tpd)"

Nekoosa Papers Inc.
SEE: Great Northern Nekoosa Corp listing in "Major firms (1000 tpd)"

New Brunswick International Paper
SEE: CIP Inc. listing in "Major firms (1000 tpd)"

Newark Boxboard Co.
SEE: Newark Group Inc. listing in "Major firms (1000 tpd)"

Newman & Co. Inc.
6101 Tacony St.
Philadelphia, Pa. 19135
Isadore Newman, president

Production facilities:

Paperboard—190 tpd chipboard, boxboard, manila, newsboard, specialty board

Newton Falls Paper Mill Inc.
(Sub. of McGraw-Hill Inc., New York, & Chilton Co., Philadelphia)
Newton Falls, N.Y. 13666
H. W. Parnass, president

Sales (1980): $80,000,000

Production facilities:

Pulp—140 tpd deinking
Paper—400 tpd fine papers, printing & publication

Niagara of Wisconsin Paper Corp.
SEE: Pentair Inc. listing in "Major firms (1000 tpd)"

Nicolet Inc.
25 Skippack Pike
Ambler, Pa. 19002
Bernard Bergman, president/chief executive officer

Sales (1980): $20,000,000

Production facilities:

HAMILTON, OHIO
(Mill idle)
Paperboard—100 tpd millboard, asbestos paper, gasket

AMBLER, PA.
Paperboard—10 tpd millboard

NORRISTOWN, PA.
Paperboard—150 tpd asbestos paper, gasket, roofing

Total production capacity:

Paperboard	260 tpd

Nicolet Paper Co.
SEE: Philip Morris Industrial Paper Group

Nitec Paper Corp.
SEE: Tembec Forest Products Inc. listing in "Major firms (1000 tpd)"

Noranda Mines Ltd.
SEE: "Major firms (1000 tpd)"

Nordfibre Corp.
Box 3100
North Bay, Ont. P1B 8K7
Frank Orsi, president/general manager

Production facilities:

Pulp—110 metric tpd groundwood
Building board—105 metric tpd asphalt, insulation board, sheathing, wallboard

North End Paper Co.
(Sub. of Robertson Paper Co. Inc.)
702 Hannibal St.
Fulton, N.Y. 13069
Samuel A. Lewis, president/general manager

Production facilities:

Paper—6 tpd pattern, waxing and wrapping tissue

North Pacific Paper Corp.
SEE: Weyerhaeuser Co. listing in "Major firms (1000 tpd)"

Northwood Forest Industries Ltd.
SEE: Noranda Mines Ltd. & Mead Corp. listings in "Major firms (1000 tpd)"

Nova Scotia Forest Industries
SEE: "Major firms (1000 tpd)"

Nu-Valley Paper Co.
N. Bridge St.
Holyoke, Mass. 01040
Daniel Bergman, president

Production facilities:

Paper—50 tpd fine papers

Ocean Falls Corp.
Box 730
Ocean Falls, B.C. V0T 1P0
E.F. Vesak, director/president/general manager

Production facilities:
(Mill idle)
Pulp—227 metric tpd groundwood
Paper—259 metric tpd newsprint

Ohio Pulp Mills Inc.
(Affil. of Donco Paper Supply Co.)
2100 Losantiville Rd.
Cincinnati, Ohio 45237
Robert Mendelson, president

Production facilities:

Pulp—25 tpd repulped paper stock (for market)

Olin Corp.
(Ecusta Paper Div.)
Pisgah Forest, N.C. 28768
Garza Baldwin Jr., Group president

Production facilities:

Pulp—180 tpd flax
Paper—cigaret, specialty and technical papers

Ontario Paper Co. Ltd.
SEE: "Major firms (1000 tpd)"

Owens-Corning Fiberglas Corp.
Fiberglas Tower
Toledo, Ohio 43659
F.L. Purtill, vice president/roofing products operating division

Roofing felt plants are included in OCF's roofing products division. Of 14 mills, only 4 were operating in mid-1982. Two mills (one active, one idle) were scheduled to be sold as part of an FTC-ordered divestiture.

Production facilities operating:

COMPTON, CALIF.
Roofing felt—75 tpd

ATLANTA, GA.
Roofing felt—70 tpd

BROOKVILLE, IND.
Roofing felt—50 tpd

MERIDIAN, MISS.
Pulp—200 tpd groundwood, 50 tpd refiner mechanical
Insulation/acoustical board—250 tpd

Current production capacity:

Pulp	250 tpd
Building board	445 tpd

Owens-Illinois
SEE: "Major firms (1000 tpd)"

Packaging Corp. of America
SEE: "Major firms (1000 tpd)"

Pacific Packaging Corp.
4444 Pacific Blvd.
Vernon, Calif. 90058
David Eklund, president

Production facilities:

Paperboard—130 tpd boxboard, chipboard, gypsum linerboard

Paper Service Mills Inc.
Hinsdale, N.H. 03451
C.B. O'Neal, chairman

Production facilities:

Paper—25 tpd napkin, toilet, packing tissue

Paper-Pak Products Inc.
1941 White Ave.
La Verne, Calif. 91750
M.G. Hopkins, chairman

Production facilities:

Paper—15 tpd cellulose wadding

Papier Cascades (Cabano) Inc.
SEE: Cascade Paper Inc.

Papier Kingsey Falls Inc.
SEE: Cascade Paper Inc.

Parsons & Whittemore Inc.
SEE: "Major firms (1000 tpd)"

Parsons Paper
SEE: NVF Co.

Pearl Paper Mills
Lackawack Rd.
Napanoch, N.Y. 12458

Production facilities:
(Mill idle)
Paper—wrapping, wrapping tissue

Pejepscot Paper
(Div. of Hearst Corp.)
Box 128
Brunswick, Maine 04011
R.A. Premo, president

Production facilities:

Pulp—150 tpd thermomechanical
Paper—165 tpd printing & publication groundwood specialties

Penacook Fibre Co.
12 N. Main
Penacook, N.H. 03301
Roland E. Allen, president/general manager

Production facilities:

Paperboard—10 tpd counter board, shoeboard, wet machine board

Pennsylvania General Paper Co.
RD 3, Box 293
Coatesville, Pa. 19320
Ralph Bicking, mill manager

Production facilities:

BUCK RUN, PA.
(Beaver Dam Mill)
Paper—25 tpd creping, toweling

Penntech Papers Inc.
600 Third Avenue
New York, N.Y. 10016
John Leslie, chairman/president

Production facilities:

JOHNSONBURG, PA
Pulp—220 tpd bleached kraft
Paper—Total 380 tpd: 285 tpd fine papers, 95 tpd printing/publication

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Pentair Inc.

SEE: "Major firms (1000 tpd)"

Perkins Paper Ltd.

SEE: Bowater Inc. listing in "Major firms (1000 tpd)"

Perkit Folding Box Corp.

36 Poydras St.
Mattapan, Mass. 02126
Sheldon Appel, president

Production facilities:

Paper—55 tpd boxboard

Philip Morris Industrial Paper Group

(Sub. of Philip Morris Inc.)
4200 N. Holton St.
Milwaukee, Wis. 53201
Richard W. Detrick, president, Paper Group

Production facilities:

PLAINWELL, MICH.
(Plainwell Paper Co.)
Paper—Total 245 tpd: printing/writing 137 tpd; special industrial 108 tpd

DE PERE, WIS.
(Nicolet Paper Co.)
Paper—140 tpd glassine, greaseproof, release, sanitary, waxing

MENASHA, WIS.
(Wisconsin Tissue Mills)
Pulp—250 tpd deinking
Paper—120 tpd napkin tissue

Total production capacity:

Pulp	250 tpd
Paper	505 tpd

Plainwell Paper Co.

SEE: Philip Morris Industrial Paper Group

Ponderosa Fibres of America

2814 New Spring Rd., Suite 205
Atlanta, Ga. 30339
Ed Sokolowsky, vice president

Production facilities:

SANTA ANA, CALIF.
(B.J. Fibres)
Pulp—100 tpd deinking (for market)

AUGUSTA, GA.
(Ponderosa Georgia Corp.)
Pulp—100 tpd deinking (for market)

MEMPHIS, TENN.
(Ponderosa of Tennessee)
Pulp—100 tpd deinking (for market)

OSHKOSH, WIS.
(Ponderosa Pulp Products Corp.)
Pulp—100 deinking (for market)

Total production capacity:

Pulp	400 tpd

Ponderosa Paper Products Inc.

SEE: APL Corp.

Pope & Talbot Inc.

1700 S. W. Fourth Ave.
Portland, Ore. 97201
Peter T. Pope, chairman/chief executive officer

This forest-products company has been diversifying into pulp/paper and now owns two tissue mills plus 50% of the Halsey pulp mill. Sales in 1981 of pulp and paper products were $108,942,000, 46% of the company total.

Production facilities:

HALSEY, ORE.
(Halsey Pulp Co.)
Pulp—175 tpd kraft (Pope & Talbot's share)

EAU CLAIRE, WIS.
Pulp—200 tpd deinking
Paper—160 tpd tissue & towel

LADYSMITH, WIS.
Pulp—60 tpd deinked
Paper—45 tpd tissue & towel

Total production capacity:

Pulp	435 tpd
Paper	205 tpd

Port Huron Paper Co.

1660 Thomas St.
Port Huron, Mich. 48060
Gordon Morseth, president/chief executive officer

Sales (1980): $54,000,000

Production facilities:

DETROIT, MICH.
Pulp—115 tpd bleached kraft
Paper—160 tpd tissue, lightweight specialties

PORT HURON, MICH.
Paper—200 tpd bond, business form, carbonizing, creping, insulating, fine papers, manifold, specialty

Total production capacity:

Pulp	115 tpd
Paper	360 tpd

Potlatch Corp.

SEE: "Major firms (1000 tpd)"

Potsdam Paper Corp.

Box 191
Potsdam, N.Y. 13678
Harry N. Walters, president

Production facilities:

Paper—115 tpd book, business form, fine papers

Prairie State Paper Mills

(Div. of Chippewa Paper Products Co.)
292 Logan
Joliet, Ill. 60433
L.G. Holzbach, president

Production facilities:

Paper & board—150 tpd chipboard, can stock & liner, kraft board, mill wrappers, roofing, saturating

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Preco Corp.

Front St.
West Springfield, Mass. 01089
J. H. Torras, president/chief executive officer

Production facilities:

LINCOLN, MAINE
(Lincoln Pulp & Paper Co. Inc.)
Pulp—350 tpd bleached kraft (some for market)
Paper—Total 260 tpd: 160 tpd fine papers, 100 tpd tissue

WEST SPRINGFIELD, MASS.
(Premoid Corp.)
Paper—30 tpd nonwovens

BROWNVILLE, N.Y.
(Brownville Paper Co.)
Paper—50 tpd special industrial, technical papers

Total production capacity:

Pulp	350 tpd
Paper	340 tpd

Premoid Corp.
SEE: Preco Corp.

Price (Nfld.) Pulp & Paper
SEE: Abitibi-Price Inc. listing in "Major firms (1000 tpd)"

Prince Albert Pulp Co. Ltd.
P.O. Box 3001
Prince Albert, Sask. S6V 5T5
R. Donnelly, director/chief executive officer
Mill is owned by Saskatchewan government

Production facilities:

Pulp—850 metric tpd bleached kraft (for market)

Prince George Pulp & Paper Ltd.
SEE: Canadian Forest Products Ltd. listing in "Major firms (1000 tpd)"

Procter & Gamble Co.
SEE: "Major firms (1000 tpd)"

Publishers Paper Co.
SEE: "Major firms (1000 tpd)"

Putney Paper Co. Inc.
316 Main St.
Putney, Vt. 05346
Earl W. Stockwell, president

Production facilities:

Paper—40 tpd tissue

Q.N.S. Paper Co. Ltd.
SEE: Ontario Paper Co. Ltd. listing in "Major firms (1000 tpd)"

Quaker Oats Co., Paper Div.
Box 520
Pekin, Ill. 61544
Bill Smithburg, president

Production facilities:

Paperboard—85 tpd boxboard, chipboard

Quesnel River Pulp Co.
Finning Rd., near Two Mile Flat
Quesnel, B.C. Z2J 3J5
Jack Rome, president

(Joint venture of West Fraser Mills Ltd. & Daishowa Canada Co. Ltd.)

Production facilities:

Pulp—450 metric tpd thermomechanical (for market)

Quin-T Corp.
Box 309
Tilton, N.H. 03276
J.C. Kingsbury, president

Production facilities:

Paperboard—asbestos, insulating, transformer board

Reading-White Hall Paper Board Co.
SEE: Maryland Paper Box Co.

Reed Paper Ltd.
SEE: "Major firms (1000 tpd)"

Rhinelander Paper Co.
SEE: Wausau Paper Mills Co. listing in "Major firms (1000 tpd)"

Riegel Products Corp.
SEE: James River Corp. of Virginia listing in "Major firms (1000 tpd)"

Rising Paper Co.
Park St.
Housatonic, Mass. 01236
Robert E. O'Connor, president

Production facilities:

Pulp—20 tpd rag
Paper—50 tpd fine papers, art, bond, bristols, papeterie, technical, specialties

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Riverside Paper Corp.
SEE: Amricon Corp.

Robel Tissue Mills Inc.
SEE: APL Corp.

G.E. Robertson & Co.
Canal St.
Hinsdale, N.H. 03451
Leo O. Gratton, president

Production facilities:

Paper—8 tpd toilet and specialty tissue

Robertson Paper Box Co. Inc.
Oakdale Rd.
Montville, Conn. 06353
Ralph A. Powers Jr., president

Sales (1980): $13,000,000

Production facilities:

Paperboard—65 tpd boxboard, chipboard, specialty board

Rock-Tenn Co.
Box 98
Norcross, Ga. 30071
A.W. Brown, chairman/chief executive officer

Sales (1980): $125,000,000

Production facilities:

CHATTANOOGA, TENN.
Paperboard—300 tpd recycled paperboard

DALLAS, TEXAS
Paperboard—375 tpd recycled paperboard

Total production capacity:

Paperboard	675 tpd

Rockford Paper Mills Inc.
7000 N. Mannheim Rd.
Rosemont, Ill. 60018
Seymour Rose, chairman

Sales (1980): $25,000,000

Production facilities:

ROCKFORD, MICH.
Paperboard—100 tpd boxboard, chipboard, folding boxboard

Rogers Corp.
Main St.
Rogers, Conn. 06263

N. L. Greenman, president
Sales (1980): $88,093,000

Production facilities:

MANCHESTER, CONN.
Paperboard—10 tpd molding board

ROGERS, CONN.
(Rogers Mill)
Paperboard/building board—35 tpd fiberboard, gasket, insulation board, specialty

Total production capacity:

Paperboard/bldg. board	45 tpd

Rolland Inc.
800 Place Victoria 3620
Montreal, Que. H4Z 1H3
Lucien G. Rolland, president/general manager
Sales (1980): C$166,978,000

Production facilities:

MONT ROLLAND, QUE.
Paper—70 metric tpd fine papers, printing/writing, rag, technical, kraft, electrical insulating, specialties

ST. JEROME, QUE.
Paper—277 metric tpd fine papers, thin papers, printing/writing & publication, business form, rag, specialties

Total production capacity:

Paper	347 metric tpd

St. Anne-Nackawic Pulp & Paper Co. Ltd.
SEE: Parsons & Whittemore Inc. listing in "Major firms (1000 tpd)"

St. Francisville Paper Co.
SEE: Crown Zellerbach listing in "Major firms (1000 tpd)"

St. Joe Paper Co.
SEE: "Major firms (1000 tpd)"

St. Raymond Paper Ltd.
1155 Dorchester Blvd. W., Rm. 2916
Montreal, Que. H3B 2H9
W.F. Clifford, president/general manager

Production facilities:

DESBIENS, QUE.
Pulp—110 metric tpd unbleached sulfite and screenings (for market)

ST. RAYMOND, QUE.
Pulp—60 metric tpd groundwood
Paper—163 metric tpd newsprint and groundwood specialties

Total production capacity:

Pulp	110 metric tpd
Paper	163 metric tpd

St. Regis Paper Co.
SEE: "Major firms (1000 tpd)"

Saxon Industries Inc.
1230 Ave. of the Americas
New York, N.Y. 10020
William Scharffenberger, president/chief executive officer

(In mid-April 1982, Saxon filed for Chapter 11 status, to reorganize under federal bankruptcy laws)

Sales (1980): $709,600,000

Production facilities:

SHELDON SPRINGS, VT.
(Missisquoi Specialty Board Div.)
Pulp—50 tpd groundwood
Paperboard—150 tpd bristols, can and cup stock, gasket, mill boards, pulpboard, other specialties

Schoeller Technical Papers Inc.
SEE: Mead Corp. listing in "Major firms (1000 tpd)"

Scott Maritimes Ltd.
SEE: Scott Paper Co. listing in "Major firms (1000 tpd)"

Scott Paper Co.
SEE: "Major firms (1000 tpd)"

Seaman Paper Co. of Massachusetts Inc.
(Sub. of Seaman Paper Co.)
Main St.
Otter River, Mass. 01436
George D. Jones, president

Production facilities:

Paper—60 tpd one-time carbonizing tissue, wrapping tissue, forms, bond, etc.

Shawano Paper Mills
SEE: Little Rapids Corp.

Shryock Bros.
Box 157
Downingtown, Pa. 19335
Robert M. McIlvain, president

Production facilities:

Paper & board—20 tpd binders board, specialty paper

Shur-Pak Industries Inc.
1899 Harper Ave., S.W.
Lenoir, N.C. 28645
J. Mast Dickson, president

Production facilities:

LENOIR, N.C.
(Mill idle)
Paper—8 tpd creped-wadding, packaging

ROCKINGHAM, N.C.
(Five Star Paper Mills)
(Mill idle)
Paper—8 tpd facial tissue, twisting tissue, wadding

Total production capacity:

Paper	16 tpd

Sierra Tissue Co. Inc.
560 E. Commercial St.
Pomona, Calif. 91766
Walter A. Richter, president

Production facilities:

Paper—12 tpd cellulose wadding

Simkins Industries Inc.
259 East St.
New Haven, Conn. 06508
Leon J. Simkins, president

Sales (1980): $117,044,000

Production facilities:

NEW HAVEN, CONN.
(New Haven Board Div.)
Paperboard—220 tpd boxboard, lined board, manila, news, patent-coated

MIAMI, FLA.
(Mill idle)
Paperboard—100 tpd boxboard, specialty

INDIANAPOLIS, IND.
(Beveridge Paper Co. Inc.)
Paperboard—60 tpd bristols, mill boards, specialty

CATONSVILLE, MD.
(Maryland Board Div.)
Paperboard—170 tpd boxboard, chipboard, cracker shell, newsboard

LEE, MASS.
(Westfield River Paper Co. Inc.)
Paper—15 tpd glassine

RUSSELL, MASS.
(Westfield River Paper Co. Inc.)
Paper—50 tpd glassine

Total production capacity:

Paper & board	615 tpd

Simplex Industries Inc.
(Div. of Anthony Industries Inc.)
3000 W. Beecher St.
Adrian, Mich. 49221
Robert D. McBeth, president

Sales (1980): $66,060,000

Production facilities:

CONSTANTINE, MICH.
Paperboard—100 tpd chipboard

PALMYRA, MICH.
Paperboard—55 tpd chipboard, felt, saturating

Total production capacity:

Paperboard	155 tpd

Simplicity Pattern Co. Inc.
200 Madison Ave.
New York, N.Y. 10016
Harold Cooper, chairman

In late 1981 sold mill at Norfolk, N.Y., to Chagrin Fibers.

Sales (1980): $86,840,000

Production facilities:

NILES, MICH.
Paper—35 tpd pattern tissue

Simpson Paper Co.
SEE: "Major firms (1000 tpd)"

Skybel Tissue Mills Inc.
63 Central Park Dr.
Holyoke, Mass. 01040
Robert Belsky, president

Production facilities:

GREENWICH, N.Y.
(Mill idle)
Paper—60 tpd tissue

Smurfit Industries
(Sub. of Jefferson Smurfit Group)
400 George St.
Alton, Ill. 62002
James B. Malloy, president

Sales (1980): $50,000,000

Production facilities:

MONROE, MICH.
(Time Container Corp.)
Paperboard—110 tpd automobile, chipboard, tube stock

Jefferson Smurfit Group
SEE: Smurfit Industries; also Alton Packaging listing in "Major firms (1000) tpd"

Sonoco Products
SEE: "Major firms (1000 tpd)"

Sorg Paper Co.
901 Manchester Ave.
Middletown, Ohio 45042
D.M. Yost, chairman/president

Sales (1980): $76,440,000

Production facilities:

Paper & board—300 tpd fine, printing/writing and specialty papers, tissue, paperboard

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F.F. Soucy Inc.
SEE: Bato Co. Inc. listing in "Major firms (1000 tpd)"

South Carolina Industries Inc.
SEE: Stone Container Corp. listing in "Major firms (1000 tpd)"

Southeast Paper Mfg. Co.
SEE: Garden State Paper listing in "Major firms (1000 tpd)"

Southwest Forest Industries
SEE: "Major firms (1000 tpd)"

Southworth Co.
Front St.
West Springfield, Mass. 01089
John H. Southworth, president

Sales (1980): $12,000,000

Production facilities:

Paper—15 tpd fine papers

Spaulding Fibre Co. Inc.
(Sub. of Monogram Ind. Inc.)
1 American Dr.
Buffalo, N.Y. 14225
Jack D. Smart, president

Production facilities:

NORTH ROCHESTER, N.H.
Paper & board—Total 60 tpd: 30 tpd special industrial paper; 30 tpd paperboard

TONAWANDA, N.Y.
Pulp—25 tpd rag
Paper—25 tpd special industrial, absorbent, for vulcanized fiber

Total production capacity:

Pulp	25 tpd
Paper & board	85 tpd

Specialty Paper Mills Inc.
8834 South Millergrove Dr.
Santa Fe Springs, Calif. 90670
J.A. Gabriel, president

Production facilities:

Paperboard—75 tpd corrugating medium

Spruce Falls Power & Paper Co.
SEE: Kimberly-Clark Corp. listing in "Major firms (1000 tpd)"

Statler Tissue Corp.
(Sub. of Statler Industries Inc.)
300 Middlesex Ave.
Medford, Mass. 02155
Leonard Sugarman, president

Production facilities:

AUGUSTA, MAINE
Paper—150 tpd facial, napkin, toilet and toweling

CLAYVILLE, N.Y.
(Doeskin Inc.)
(Mill idle)
Paper—75 tpd tissue, wadding

Total production capacity:

Paper	225 tpd

Stevens Paper Mills Inc.
77 Mill St.
Westfield, Mass. 01085
David R. Schoales, president

Production facilities:
(Mill idle)
Paper—8 tpd specialty tissue

Stevens & Thompson Paper Co.
Box 206
Greenwich, N.Y. 12834

Production facilities:

Paper—60 tpd facial, toilet and toweling tissue

Stone Container Corp.
SEE: "Major firms (1000 tpd)"

Strathcona Paper Co.
(Div. of Roman Corp. Ltd.)
Strathcona, Ont. K7R 3L6
W.E. Riddolls, president

Production facilities:

Paperboard—130 metric tpd boxboard, chipboard, newsboard

Strathmore Paper Co.
SEE: Hammermill Paper Co. listing in "Major firms (1000 tpd)"

Superior Fiber Products Inc.
N. 5th St. & Bayfront, Box 365
Superior, Wis. 54880
C.H. Hedman, president/general manager

Sales (1980): $14,000,000

Production facilities:

Pulp—275 tpd defibrated
Building board—hardboard

Superwood Corp.
SEE: "Major firms (1000 tpd)"

Sweetwater Paper Board Co.
(Div. of Caraustar Industries Inc.)
5700 Paper Mill Rd.
Austell, Ga. 30001
Alford L. Smith, president

Production facilities:

Paperboard—325 tpd core stock & cores, folding boxboard, gypsum linerboard, linerboard

Tagsons Papers Inc.
Mechanicville, N.Y. 12118
Nicholas T. Galante, president

Production facilities:

Paper—120 tpd toweling, creping paper & tissue

Tahsis Co. Ltd.
SEE: CIP Inc. listing in "Major firms (1000 tpd)"

Tallman Conduit Co.
600 S. Main St.
Louisiana, Mo. 63353
Roscoe B. Tallman, president/treasurer

Production facilities:

Building board—pipe conduit

Tamko Asphalt Products Inc.
601 N. High St.
Joplin, Mo. 64801
Ethelmae Humphreys, chairman

Sales (1980): $50,000,000

Production facilities:

PHILLIPSBURG, KAN.
(Tamko Asphalt Products of Kansas Inc.)
Building board—80 tpd roofing felt

JOPLIN, MO.
Building board—140 tpd roofing felt

KNOXVILLE, TENN.
Pulp—40 tpd defibrated
Building board—150 tpd roofing felt

Total production capacity:

Pulp	40 tpd
Building board	370 tpd

Tecumseh Corrugated Box Co.
Box 427
Tecumseh, Mich. 49286
James Robideau, president

Sales (1980): $20,000,000

Production facilities:

BRECKSVILLE, OHIO
(Jaite Mill Div.)
Paperboard—70 tpd chipboard, bogus

Tembec Forest Products
SEE: "Major firms (1000 tpd)"

Tennessee River Pulp & Paper Co.
SEE: Packaging Corp. of America listing in "Major firms (1000 tpd)"

Texon Inc.
Canal St.
South Hadley, Mass. 01075
Lee Asseo, president

Sales (1980): $125,000,000

Production facilities:

RUSSELL, MASS.
Paper & board—150 tpd art paper, coating base, counterboard, specialty paper & board

SOUTH HADLEY, MASS.
(South Hadley Mill)
Paper & board—coating base, impregnating, saturating, specialty board

Thilmany Pulp & Paper Co.
SEE: Hammermill Paper Co. listing in "Major firms (1000 tpd)"

3M Co.
3M Center
St. Paul, Minn. 55144
D.C. Vadnais, general manager

Production facilities:

HARTFORD CITY, IND.
(Carbonless and Related Products Div.)
Paper—50 tpd business forms paper

Three Rivers Pulp & Paper
SEE: Kruger Inc. listing in "Major firms (1000 tpd)"

Thurso Pulp & Paper Co.
SEE: Noranda Mines Ltd. listing in "Major firms (1000 tpd)"

Time Container Corp.
SEE: Smurfit Industries

Time Inc.
SEE: "Major firms (1000 tpd)"

Tomahawk Power & Pulp Co.
Kings Dam Rte. 5, Box 210
Tomahawk, Wis. 54487
W.H. Schockley III, plant manager

Production facilities:

Pulp—30 tpd groundwood (for market)

Toronto Paperboard Co.
Loretta Ave.
Toronto, Ohio 43964
R.J. Crego, president

Production facilities:

Paperboard—150 tpd boxboard, chipboard, containerboard, core stock, specialties

Trent Valley Paperboard Mills
Glen Miller, Ont. K8V 5R8
R.M. Bryden, president/chief executive officer

Production facilities:

Paperboard—280 metric tpd boxboard, chipboard, core stock & cores, specialties

Union Camp Corp.
SEE: "Major firms (1000 tpd)"

U.S. Paper Mills Corp.
Box W-98, Ft. Howard Ave.
De Pere, Wis. 54115
Walter R. Cloud, president/treasurer

Sales (1980): $8,200,000

Production facilities:

Paperboard/building board—83 tpd can & core stock, boxboard, chipboard, building paper & board

United States Gypsum Corp.
SEE: "Major firms (1000 tpd)"

United States Paper Mills Inc.
Hollywell Ave.
Chambersburg, Pa. 17201
Dunbar A. Rosenthal, president/treasurer

Production facilities:

Paper—35 tpd creping, industrial, toweling

Upson Co. Inc.
Box 508
Lockport, N.Y. 14094
J.J. Upson, chairman

Sales (1980): $12,930,000

Filed for bankruptcy in 1980.

Production facilities:
(Mill idle)
Building board—140 tpd wallboard, chipboard, construction board

Valentine Pulp & Paper Co.
SEE: Litton Industries Inc.

Vermont Tissue Paper Corp.
Rte. 67-A
North Bennington, Vt. 05257
Edward Woodward, president

Production facilities:
Paper—10 tpd tissue

Vincennes Paper Mill Inc.
SEE: American Paper Products Co.

Virginia Fibre Corp.
SEE: "Major firms (1000 tpd)"

Ward Paper Co.
(Div. of Arvey Corp.)
N. Mill St.
Merrill, Wis. 54452
Bruce Skofronick, vice president/general manager

Sales (1980): $15,000,000

Production facilities:

Pulp—60 tpd deinking
Paper—90 tpd bond, duplicator, mimeograph, fine papers

Warrensburg Board & Paper Corp.
Warrensburg, N.Y. 12885
Arthur Radin, president

Production facilities:

Paperboard—70 tpd corrugating medium, linerboard, kraft board, wrapping tissue

Watervliet Paper Co.
SEE: Howard Paper Mills Inc.

Wausau Paper Mills Co.
SEE: "Major firms (1000 tpd)"

Welclad Industries Canada Ltd.
515 Munroe Ave.
Winnipeg, Man. R2K 1H7
E. L. Cherwick, president

Production facilities:

Pulp—groundwood
Paper/board—wallboard, fiberboard

Western Electric Co.
(Sub. of AT&T Co.)
222 Broadway
New York, N.Y. 10038

Sales (1980): $12,030,000,000

Production facilities:

CHICAGO, ILL.
(Hawthorne Works)
Paperboard—35 tpd electrical insulating

Westfield River Paper Co. Inc.
SEE: Simkins Industries Inc.

Weston Paper & Mfg. Co.
2001 N. 19th St., Box 238
Terre Haute, Ind. 47808
M.T. Hubbard, chairman

Production facilities:

Pulp—270 tpd semichemical
Paperboard—425 tpd corrugating medium

Weyerhaeuser Co.
SEE: "Major firms (1000 tpd)"

Whippany Paper Board Co.
101 N. Jefferson Rd.
Whippany, N.J. 07981

Declared bankruptcy in 1980. Durham mill in Durham, Pa., sold to Durham Mills Inc. in 1981. Eden mill at Whippany, N.J., expected to be sold to Container Corp. of America, per option signed in mid-1982. Two other mills dismantled; remaining mill in Clifton is for sale.

Production facilities:

CLIFTON, N.J.
(Mill idle)
Recycled paperboard—350 tpd

WHIPPANY, N.J. (Eden Mill)
(Mill idle)
Recycled paperboard—1000 tpd

White Pigeon Paper Co.
Box 277
White Pigeon, Mich. 49099
James V. Lamarre, president

Production facilities:

Paperboard—150 tpd boxboard

George A. Whiting Paper Co.
100 River St.
Menasha, Wis. 54952
Frank B. Whiting, chairman/chief executive officer

Production facilities:

Paper—22 tpd art paper, fine papers, papeterie, specialties

Willamette Industries Inc.
SEE: "Major firms (1000 tpd)"

Windsor Stevens Inc.
Stevens Mill Rd.
Windsor, Conn. 06095
Milton Gordon, president

Production facilities:

Paperboard—10 tpd insulating, fiberboard, pressboard, trunk board

Wisconsin Paperboard Corp.
SEE: Newark Group Inc. listing in "Major firms (1000 tpd)"

Wisconsin Tissue Mills
SEE: Philip Morris Industrial Paper Group

Wood Flong Corp.
Davis St.
Hoosick Falls, N.Y. 12090
Calvin P. Otto, chairman/president

Sales (1980): $4,000,000

Production facilities:

Paperboard—15 tpd binders board

Woodstream Corp.
Front & Locust Sts.
Lititz, Pa. 17543
R.G. Woolworth, president/chairman

Sales (1980): $50,390,000

Production facilities:

Molded pulp products—3.6 tpd

Yorktowne Paper Mills Inc.
Loucks Mill Rd.
York, Pa. 17405
Daniel J. Sparler, chairman/treasurer

Production facilities:

GARDINER, MAINE
(Yorktowne Paper Mills of Maine Inc.)
Paper & board—80 tpd chipboard, car & case lining, core stock & cores, specialties

YORK, PA.
Paper—95 tpd boxboard, chipboard, can & core stock & cores, fiberboard

Total production capacity:

Paperboard	175 tpd